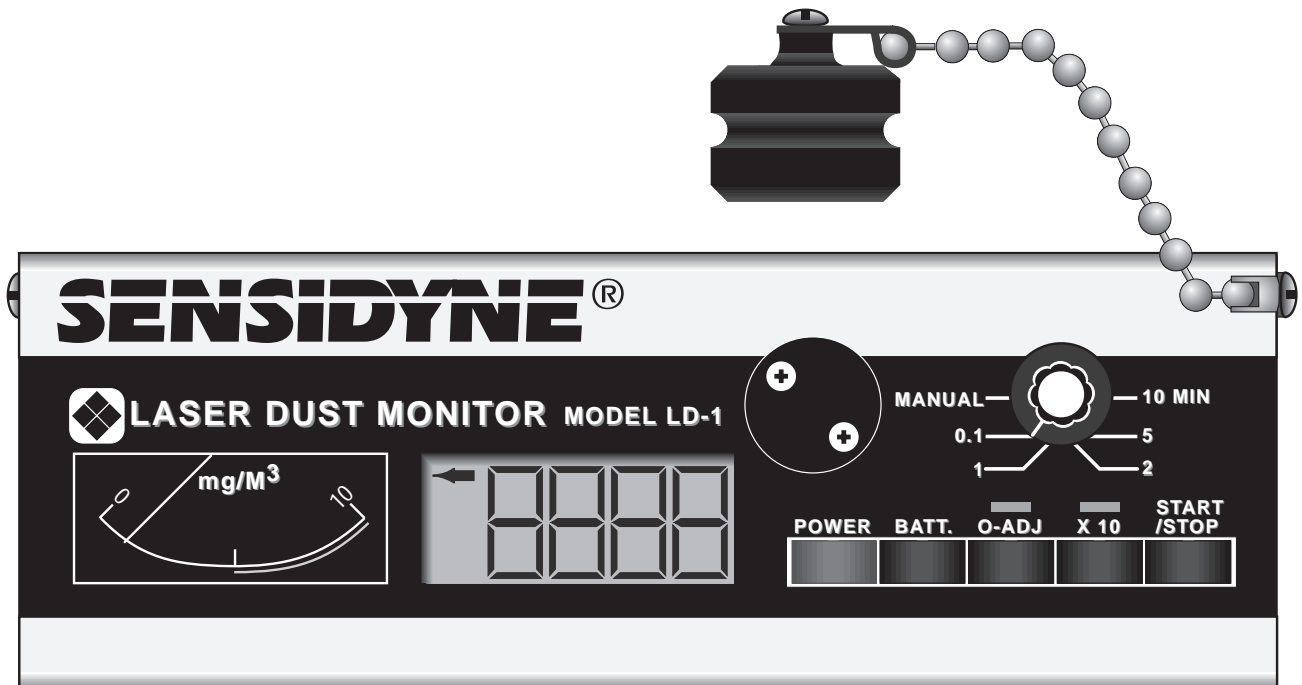


# LASER DUST MONITOR



## **OPERATION & SERVICE MANUAL** **for the following Laser Dust Monitor models:**

**7012201-1 (LD-1)**  
**7012201-2 (LD-1H)**

### **WARNING**

Class I laser product with embedded Class IIIb invisible laser diode (781 nanometers, 3 milliwatts) inside internal laser optics housing. Internal access by authorized personnel only. This product complies with 21 CFR 1040.10 and 1040.11.

**SENSIDYNE**<sup>®</sup>

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**Revision C • October 1996 (Document No. 7012201-1M)**



# PACKING LIST

The items listed below are shipped with the **Sensidyne Laser Dust Monitor**:

- Laser Dust Monitor (either Model LD-1 or LD-1H)
- Cleaning brush
- Operation & Service Manual

***ALWAYS check to make certain  
you have received all of the items listed above.***

***If you have any questions or need assistance,  
contact your Sensidyne Sales Representative, or call***

**800-451-9444**

**or**

**727-530-3602**

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# WARNINGS !

## READ AND UNDERSTAND ALL WARNINGS BEFORE USE

### CAUTION

**Use of controls or adjustments or performance of procedures other than as specified herein may result in hazardous radiation exposure.**

Read and understand **ALL** warnings before using this product. Failure to read, understand, and comply with **ALL** warnings could result in property damage, severe personal injury, or death.

Read and understand **ALL** applicable Federal, State, and Local environmental health and safety laws and regulations, including OSHA. Ensure complete compliance with **ALL** applicable laws and regulations before and during use of this product.

**UNDER NO CIRCUMSTANCES** should this product be used except by qualified, trained, technically competent personnel and not until the warnings, *Operation and Service Manual*, labels, and other literature accompanying this product have been read and understood.

The *Operation and Service Manual* must be read and understood by each user before operating this product or using its accessories, in order to ensure proper and safe use and installation of this product and to ensure familiarity with the proper treatment and safety procedures in the event of an accident.

**DO NOT** remove, cover, or alter any label or tag on this product, its accessories, or related products.

**DO NOT** operate this product should it malfunction or require repair. Operation of a malfunctioning product, or a product requiring repair may result in serious personal injury or death. **DO NOT** attempt to repair or modify the instrument, except as specified in the *Operation and Service Manual*. Contact the Sensidyne Service Department to arrange for a Returned Material Authorization (RMA).

Use **ONLY** genuine SENSIDYNE® replacement parts when performing any maintenance procedures described in this manual. *Failure to do so may seriously impair instrument performance.* Repair or alteration of the product beyond the scope of these maintenance instructions, or by anyone other than a certified SENSIDYNE® service technician, could cause the product to fail to perform as designed and persons who rely on this product for their safety could sustain severe personal injury or death.

This instrument utilizes an internal laser beam that may cause injury to eyes and skin if direct contact is made. **DO NOT** attempt unauthorized repairs of the instrument. All internal repairs should be made by a SENSIDYNE® service technician.

Direct contact with laser beams can cause injury to eyes and skin. This instrument utilizes an internal laser beam that is housed in a module so as to be inaccessible to the user in normal operation. **DO NOT** attempt repairs of the laser/optics. **ALL** such repairs should be made by the Sensidyne® service technician. **DO NOT** apply power to a laser optics module that is removed from the instrument. The laser output is at 781 nanometers wavelength and 3 milliwatts of power. It is **NOT** visible to the human eye.

This product is not rated explosion proof or intrinsically safe. **DO NOT** operate this product in explosive or flammable environments.

# SECTION ONE

## INTRODUCTION

### 1.1 INTRODUCTION

This manual provides information concerning the operation, calibration, and maintenance of the Sensidyne Laser Dust Monitor. *To ensure proper operation of the Laser Dust Monitor, you should first read this manual in its entirety.*

The portable Laser Dust Monitor is available in two models: LD-1 (Normal Sensitivity) and LD-1H (High Sensitivity). The Model LD-1 has a measuring range of 0.01–100 mg/M<sup>3</sup>, while the Model LD-1H has a measuring range of 0.001–10 mg/M<sup>3</sup>. Both ranges are based on Arizona Road Dust (fine).

The Model LD-1 and LD-1H monitors are sensitive to airborne dust particles, fumes, mists, and aerosols. Both monitors determine relative dust concentrations by measuring the intensity of light scattered by the dust. The concentration for a particular dust of interest is calculated by multiplying the readout by a conversion coefficient (K-value). The K-value is determined by the user by means of a one-time side-by-side test with a gravimetric sampler.

### 1.2 PRINCIPLE OF OPERATION

The Sampling Air Inlet (see Figure 1.1) allows air to be drawn from the full 360° area surrounding the monitor. The inlet also prevents ambient light from entering the unit and minimizes the effect of wind velocity.

Ambient air is drawn into the Sampling Air Inlet at the rate of 3.4 LPM via a fan. The air passes at a right angle through a low power laser beam where a photo-electric diode detects the scattered light and produces an electrical signal. The detector assembly is positioned to provide optimum sensitivity to the size distribution of respirable dust (0–10 µm). A filtered clean purge air prevents dust from collecting on the optical components.

Capping the air inlet permits filtered clean air to purge the optical chamber of the dust monitor, thus producing a proper environment for zero and sensitivity adjustments of the instrument.



### 1.3 COMPONENTS

For the following descriptions, refer to Figure 1.1 through Figure 1.4.

- **Air Sampling Inlet**

Allows air to be drawn from the full 360° area surrounding the monitor, while preventing ambient light from entering the unit. The design of the Sampling Air Inlet also minimizes the effect of wind velocity.

- **Ratometer (Analog Meter)**

Provides a real-time reading of relative dust concentration, monitoring of background value, and battery check.

**Range: Model LD-1**

0.01–10 mg/M<sup>3</sup>

0.1–100 mg/M<sup>3</sup> (“x10” button pressed)

**Range: Model LD-1H**

0.001–1 mg/M<sup>3</sup>

0.01–10 mg/M<sup>3</sup> (“x10” button pressed)

- **Counter (LCD Display)**

Provides a digital reading (count) of the relative dust concentration for the time indicated on the timer. During counting an arrow is displayed on the upper left portion of the LCD (refer to Figure 1.1). When the “X10” button is pressed, the count value is multiplied by 10 to obtain the actual count. To determine the counts per minute (CPM) use the following equation:

$$\text{Counts per Minute (CPM)} = \frac{\text{Count Value}}{\text{Measuring Time (in minutes)}}$$

**NOTE**

*The count value on the LCD Counter is unreliable when the needle on the Ratometer exceeds its upper limit.*

- **Timer Control (6-position, Quartz Oscillation)**

Used to set the measuring time in minutes. Manual mode allows continuous monitoring until stopped by the operator.

- **“POWER” (Red Button)**

Turns the Laser Dust Monitor On and Off.

- **“BATT.” (Button)**

Checks the battery charge. The battery charge level is displayed in the Analog Ratometer window. The battery charge can be checked any time during measurement.

**NOTE**

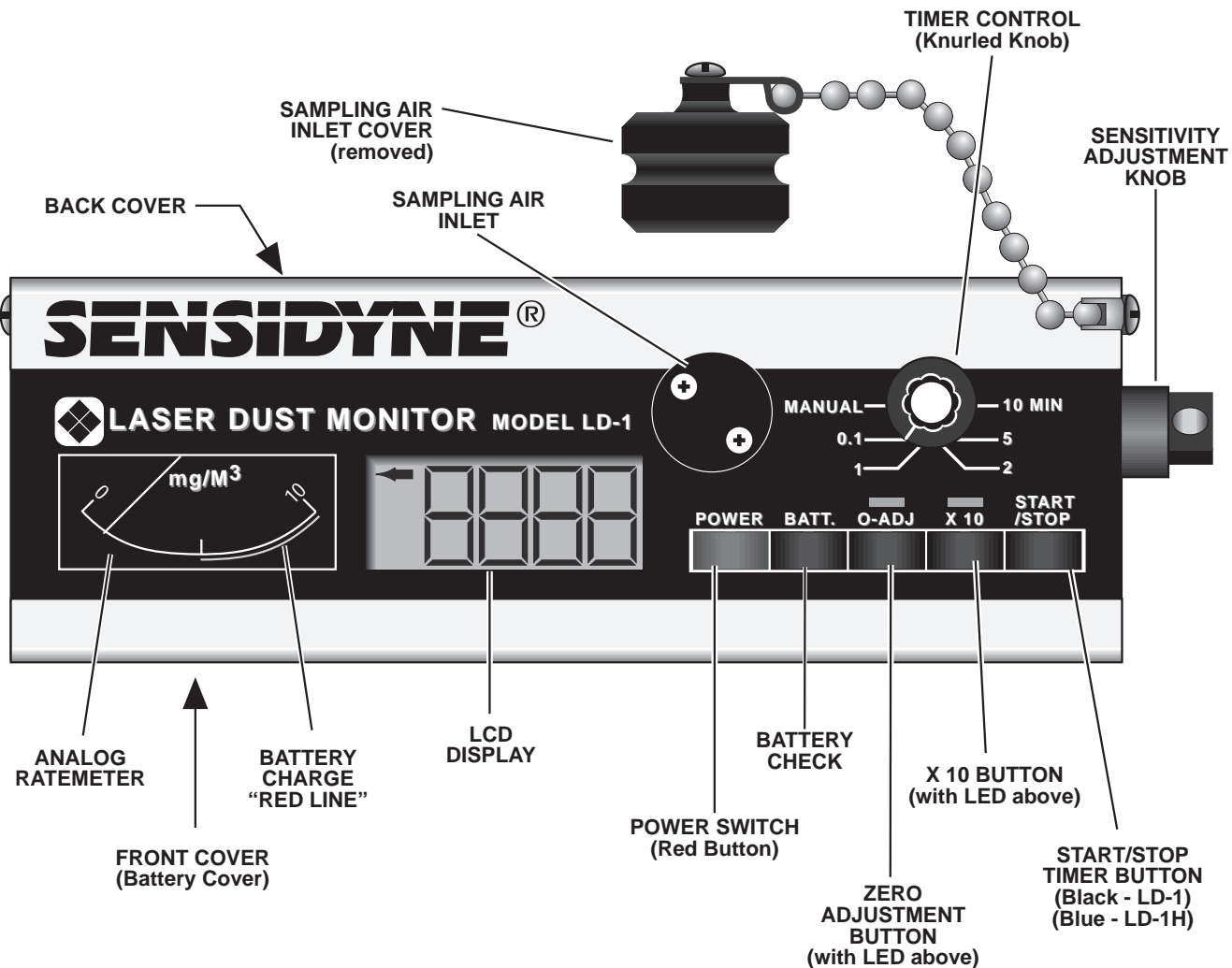
*The Laser Dust Monitor should be operated only when the charge level is in the red line range. If the charge is below the red line range, recharge or replace the batteries.*

- **“0-ADJ” (Button)**

Activates the zero-adjustment mode.

- **“X10” (Button)**

Lowens the sensitivity of the monitor by a factor of ten. When activated, an indicated value on the Ratometer and the count value on the LCD must be multiplied by ten in order to determine the correct (actual) count value. The recorder output must be calculated in the same manner. **Note:** This button is pushed when the monitor is used at a location where a high dust concentration is expected (i.e., where the Analog Ratometer may exceed 10 mg/M<sup>3</sup> (LD-1) or 1 mg/M<sup>3</sup> (LD-1H) , or when a total count on the LCD Counter is expected to exceed 9999.



**Figure 1.1**  
**Laser Dust Monitor: Top View**

- **“START/STOP” (Button)**

Used to start the counter for the time set by the Timer control. If pressed during a count cycle, counting will be stopped. (This button is black on the Model LD-1 and blue on the Model LD-1H.)

- **Sensitivity Adjustment Knob**

Used to move a built-in, light-scattering board into the path of the laser beam. This standard board (based on polystyrene latex particles) is used for sensitivity adjustment.

---

**CAUTION**

*DO NOT force the Sensitivity Adjustment Knob, or loosen the hex nut on the shaft. If the knob is forced out of alignment on its shaft, the unit will have to be returned to the factory for realignment.*

---

- **“SENSI. ADJ.” (Potentiometer)**

Adjusts the sensitivity of the unit to the value (S-value) of a standard light-scattering board.

- **“0-ADJ.” (Potentiometer)**

Adjusts the “zero value” of the unit.

- **“OUTPUT” (Port)**

Recorder output port (DIN-5) which provides 0–1 volt output. (Optional cable available, PN° 7016430).

- **“EXT DC” (Port)**

Allows continuous operation from an AC source using an AC adapter. Also used to charge the nickel-cadmium batteries (with an AC adapter).

- **“PUSH” (2 Buttons)**

Allows access to the battery compartment. The “PUSH” buttons are located on opposite ends of the unit. It is necessary to push these buttons at the same time in order to release the compartment lid.

- **Exhaust Air “OUTLET” (Port)**

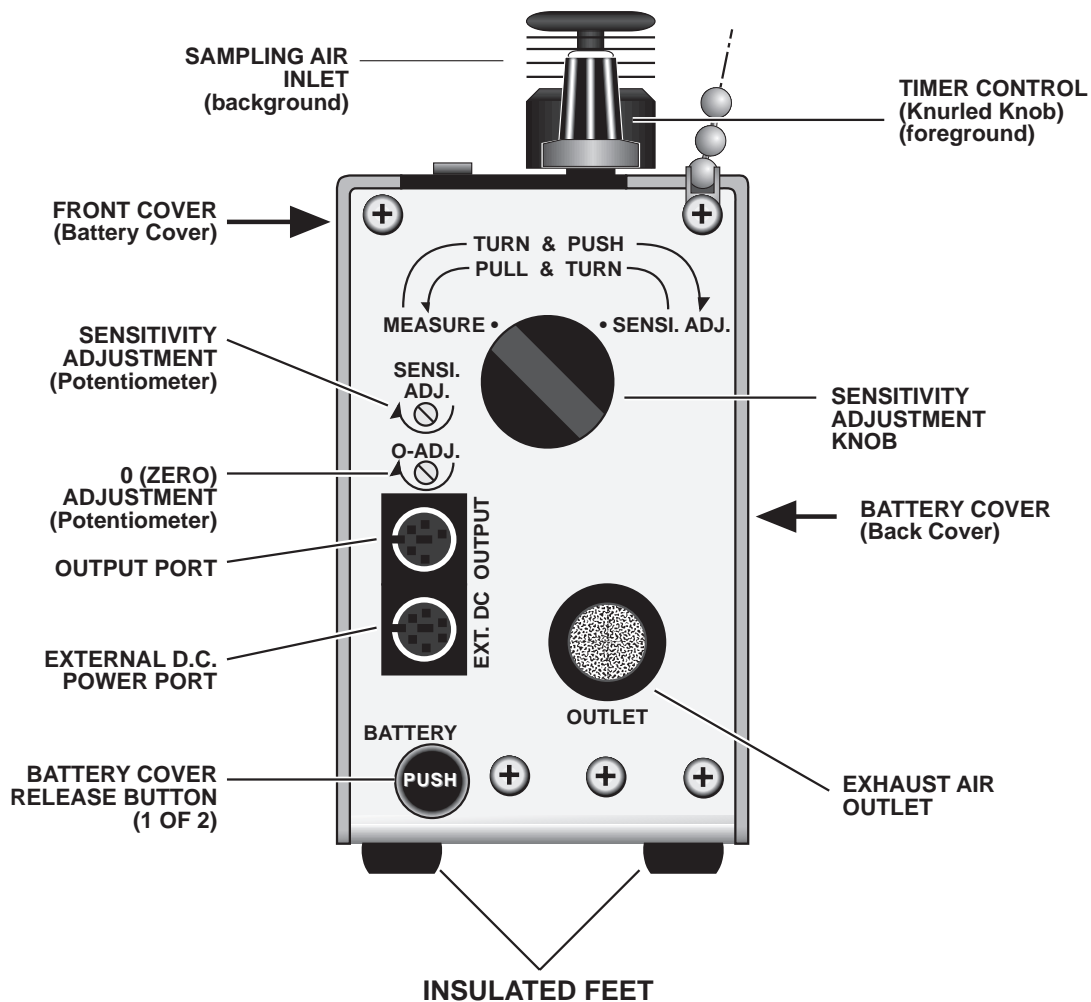
Used for expelling air that has been drawn into unit through Sample Air Inlet.

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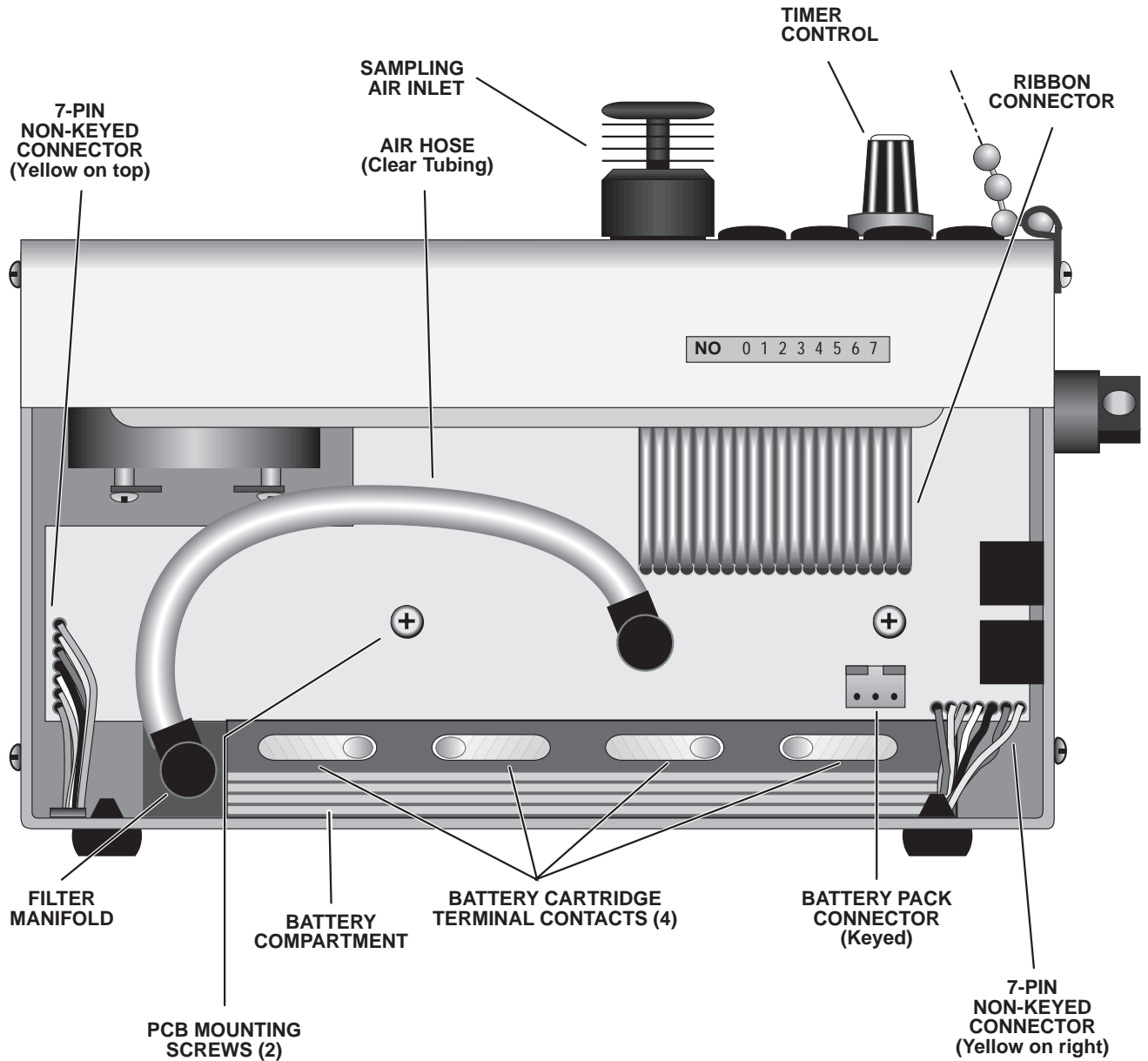
**NOTE**

*The Exhaust Air Outlet should not be blocked during measurement.*

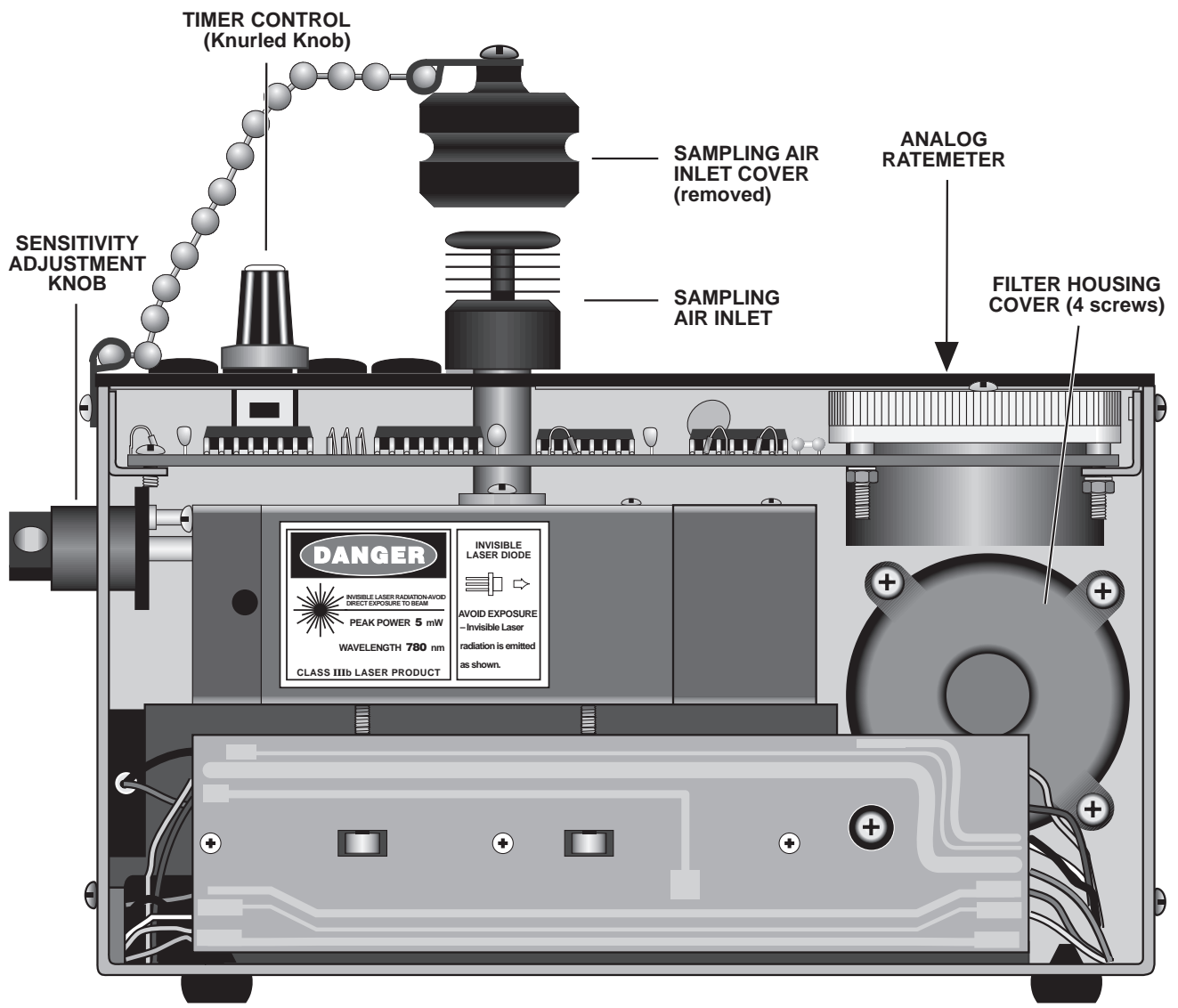
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**Figure 1.2**  
**Laser Dust Monitor: Right Side View**



**Figure 1.3**  
**Internal Components: Front View**



**Figure 1.4**  
**Internal Components: Back View**

## 2.1 INITIAL SET UP

The Laser Dust Monitor comes with 8 dry cell batteries and a battery cartridge, which must be installed prior to initial use. The Laser Dust Monitor may be operated using any of three available power sources:

- (standard) Eight (8) AA batteries. The batteries may be either standard dry cell, or Alkaline (recommended).
- (optional) A rechargeable nickel-cadmium Battery Pack, (PN° 7016429-1). See Section 4.2.1 for installation.
- (standard) A 115 VAC to 12 Vdc adapter. The AC adapter can be used by attaching one end to the EXT DC port on the right side of the monitor (see Figure 1.2) and plugging the other end into a standard 115 VAC outlet.

To install the standard battery cartridge, do the following (refer to Figure 1.3):

- 1) Insert the 8 batteries into the cartridge, following the position diagram printed on the inside bottom of the cartridge. The positive (+) and negative (-) terminals of the batteries must be positioned correctly in order for the unit to operate.
- 2) Place the unit so the battery (front) cover is up. Remove the battery cover by pressing on the PUSH buttons found at each end of the unit. (It is necessary to press these buttons at the same time in order to remove the cover.)
- 3) Position the cartridge so the silver tabs (contacts) are facing toward the battery compartment. Place the battery cartridge inside the battery compartment.
- 4) Replace the battery cover.

### NOTE

*The battery cover must be securely in place in order for the unit to operate.*

## 2.2 ADJUSTMENTS

Zero and Sensitivity adjustments should be made before initial use, and at regular intervals not to exceed one (1) month. However, it is best to check the Zero and Sensitivity values before each use and adjust as necessary.

### NOTE

*Complete the zero adjustment procedure before proceeding with the sensitivity adjustment procedure.*

### 2.2.1 Zero Adjustment

Refer to Figure 1.2 and perform zero adjustment as follows:

- 1) Cap the Sampling Air Inlet.
- 2) Activate the unit and switch the Timer Control to 0.1 minute.
- 3) Press the 0-ADJ button. Note that the red light above the button is on.
- 4) Carefully pull and turn the Sensitivity Adjustment Knob until it points to the MEASURE position.

### CAUTION

*DO NOT force the Sensitivity Adjustment Knob, or loosen the hex nut on the shaft. If the knob is forced out of alignment on its shaft, the unit will have to be returned to the factory for realignment.*

- 5) Press the START/STOP button to begin a 6 second (0.1 minute) count cycle.
- 6) Observe and record the number indicated on the LCD once the count cycle has been completed. If the count reads “2” (corresponding to 20 mg/M<sup>3</sup> on the Ratemeter), go to Step 7. If the count does not read “2,” proceed to Step 6 (a).
  - a) Turn the 0-ADJ potentiometer with a small jeweler’s screwdriver (3/32” blade width). Turn clockwise to increase the value and counter-clockwise to decrease the value. **Note:** *Adjustments should be made in small (1/8-turn) increments.*
  - b) Press the START/STOP button to begin another 6 second count cycle.
  - c) Observe the LCD reading. If it reads “2” go to Step 7. If it does not read “2,” repeat Steps 6 (a) through 6 (c) until a “2” is indicated.
- 7) Depress the 0-ADJ button and note that the red light above this button is off and the Ratemeter is registering “0” mg/M<sup>3</sup>.

### 2.2.2 Sensitivity Adjustment

---

#### NOTE

**Complete the zero adjustment procedure before proceeding with the sensitivity adjustment procedure.**

---

Refer to Figure 1.2 and perform the sensitivity adjustment as follows:

- 1) Cap the Sampling Air Inlet.
- 2) Activate the unit and switch the TIMER Control to 1 minute.
- 3) Carefully turn and push the Sensitivity Adjustment Knob until it points to the SENSI ADJ position. This moves a standard light-scattering board made of (0.6 μm) polystyrene latex particles into the optical path of the laser.

---

#### CAUTION

**DO NOT force the Sensitivity Adjustment Knob, or loosen the hex nut on the shaft. If the knob is forced out of alignment on its shaft, the unit will have to be returned to the factory for realignment.**

---

- 4) Press the START/STOP button to begin a 1 minute count cycle.
- 5) Observe and record the number indicated on the LCD once the count cycle has been completed. If the count is within ± 5% of the “S-value” (listed on the Test Report and on an external label on each unit), the unit is ready for monitoring. If the count is greater than ± 5% of the “S-value,” proceed to Step 5 (a).
  - a) Adjust the SENSI ADJ potentiometer with a small jeweler’s screwdriver (3/23” blade width). Turn clockwise to increase, counter-clockwise to decrease. **Note:** *Adjustments should be made in small (1/8-turn) increments.*
  - b) Press the START/STOP button to begin another 1 minute count cycle.
  - c) Observe the LCD reading. Repeat Steps 5 (a) through 5 (c) until the LCD value is within ± 5% of the “S-value.”



## 2.3 MEASUREMENT

The following steps should be taken to obtain a valid measurement of dust concentration in a target area:

- 1) Press the POWER button to activate the monitor. Allow the unit to warm-up for 3 minutes before proceeding with the measurement.
- 2) Set the TIMER Control to the desired sampling time.
- 3) Remove the cap covering the Sampling Air Inlet.
- 4) Pull and turn the Sensitivity Adjustment Knob counter-clockwise to the MEASURE position.
- 5) Press the START/STOP button to begin measuring the ambient air. Note the arrow in the upper left-hand corner of the LCD counter. This indicates that a count is in progress. Dust measurement will automatically stop at the end of the selected time period (unless MANUAL has been selected). The real-time mg/M<sup>3</sup> value is displayed on the Ratemeter, while the count value is displayed on the LCD.
- 6) To obtain a CPM (Count Per Minute) value from the LCD counter, simply divide the count displayed on the LCD by the measuring time (in minutes). (When using the manual mode, be certain to start the timing as the START/STOP button is depressed, and stop the timing as the START/STOP button is pressed again.) To obtain a concentration value for a particular dust of interest (mg/M<sup>3</sup>), multiply the CPM times the "K-value" (see Section Four: Calibration):
  - 7) Recap the Sampling Air Inlet and wait several seconds before pressing the POWER button to deactivate the monitor. (This allows any dusty air inside the instrument to be expelled, thus preventing unwanted dust build-up inside the monitor.) Always store the unit with the Sensitivity Adjustment Knob in the SENSI ADJ position.
  - 8) Remote sampling can be achieved with the use of 3/8" I.D. Tygon® tubing, tubing connectors, and a personal monitoring pump. To use remote sampling, do the following:
    - a) Remove the Air Sampling Inlet (turn counter-clockwise), install the Inlet Tubing Connector (PN° 7016431), and attach a length of Tygon tubing (maximum length = 12 ft.)
    - b) Install the Exhaust Tubing Connector at the Outlet. Attach a length of 3/8" I.D. tubing to the connector.
    - c) Attach a pump to the Exhaust Connector via a short length of Tygon® tubing. The pump must run at 3.4 LPM.

$$\text{Dust Conc. (mg/M}^3\text{)} = \text{K-value} \cdot \text{CPM}$$

# SECTION THREE

# CALIBRATION

## 3.1 INTRODUCTION

To determine dust concentrations, both the LD-1 and the LD-1H must be calibrated for the size and type of dust found in a particular target environment. Calibration involves the calculation of a conversion factor (K-value) that is used to provide a direct reading of dust concentration levels in  $\text{mg}/\text{M}^3$ . Calibration should be done annually.

The K-value is calculated through simultaneous sampling with the unit and a gravimetric filtration sampler. Sensidyne personal monitoring pumps BDX 44, BDX 55, BDX 74, BDX 530, or BDX 530 CF/CFT are recommended. Contact Sensidyne for ordering information.

### NOTE

*It is recommended that the unit be returned to Sensidyne annually for a calibration check against a reference device.*

## 3.2 CALIBRATION PROCEDURE

To determine the K-value do the following:

- 1) Carefully select a representative measuring point for the calibration.
- 2) Place the Laser Dust Monitor next to a respirable filtration sampler such that the Sampling Air Inlet of the monitor is at the same height as the filtration sampler. If all the dust in the target environment is not in the respirable range (0-10  $\mu\text{m}$ ), a separator, such as a cyclone, should be used in conjunction with the filtration sampler. A Sensidyne Cyclone Sampler BDX 99R (5  $\mu\text{m}$  PVC filter membrane at 1.7 LPM) is recommended.
- 3) Weigh the filter from the filtration sampler.
- 4) Set the unit to the manual setting on the timer. Press the X10 button (unless the dust concentration is  $< 0.5 \text{ mg}/\text{M}^3$ ). Allow both monitors to operate for a fixed time interval (3–8 hours) depending on the dust concentration. The approximate concentration can be determined from the analog ratemeter. For example, if the concentration is  $2.0 \text{ mg}/\text{M}^3$  by the ratemeter (with the X10 button off), the unit can operate approximately 500 minutes before the LCD exceeds 9999 and starts again at 1.
- 5) Weigh the filter again, and subtract from this weight the weight of the filter prior to measurement.
- 6) Divide the resulting weight by the number of minutes in the sampling interval and then multiply the result by 588 to obtain a dust concentration reading in  $\text{mg}/\text{M}^3$ .
- 7) Calculate the K-value using the formula:  $\mathbf{K = D / R}$ ,  
Where:  
K = Conversion factor  
D = Dust concentration ( $\text{mg}/\text{M}^3$ ) from the filtration sampler  
R = Relative dust concentration (CPM) from the dust monitor
- 8) Repeat the above measurement several times to obtain a reliable K-value.

## 4.1 FILTER REPLACEMENT

### **WARNING**

***THIS INSTRUMENT INCORPORATES A LASER BEAM IN THE LASER OPTICS MODULE THAT MAY CAUSE INJURY TO EYES AND SKIN IF DIRECT CONTACT IS MADE. DO NOT ATTEMPT UNAUTHORIZED REPAIRS OF THIS INSTRUMENT. ALL REPAIRS SHOULD BE MADE BY SENSIDYNE® SERVICE PERSONNEL.***

The filter should be replaced once a year. However, in very dusty environments it may be necessary to change the filter more frequently.

If the response time of the instrument increases significantly, the filters should be changed. Or, if the flow of air at the Sampling Air Inlet drops below 65 ft/min (1.0 LPM) [measured with the optional inlet adapter installed], then change the filters. The normal flow is 220 ft/min (3.4 LPM).

The flow can be measured with a thermal anemometer (such as the Kurz Model 491 Mini Anemometer from Carmel Valley, CA). The air flow must be measured with the optional inlet adapter installed.

### **NOTE**

***To protect the Electrostatic Discharge (ESD) sensitive components in the Laser Dust Monitor, a Grounding Wrist Strap must be worn at all times when servicing the unit.***

To replace the filters of the Laser Dust monitor, perform the following steps (refer to Figure 1.3 and Figure 1.4):

### **IMPORTANT**

***It is highly recommended that this procedure be performed ONLY by trained instrument personnel. The dust monitor may be returned to Sensidyne for filter replacement for a nominal charge.***

- 1) Turn the power off. Place the unit in an upright position. Remove the battery cover (front cover) by pressing on the PUSH buttons found at each end of the unit. (It is necessary to press these buttons at the same time in order to remove the cover.)
- 2) Unplug and remove the battery pack (cartridge) from the unit.

### **WARNING**

***Omission of Step 2 can result in damage to the printed circuit board.***

- 3) Turn the monitor around (back side forward) and remove the four screws securing the cover to the back of the unit. (The screws are found at each end of the unit.) Remove the cover.
- 4) Remove the four screws from the round filter housing and remove the cover. Remove and discard the dirty filter. Scrape any filter fragments from the filter housing, being careful not to get any fragments inside of the housing.
- 5) Remove the two screws found on the bottom side of the unit.
- 6) Turn the unit around (front side up) and loosen the circuit board as follows:
  - a) Carefully unplug the wide ribbon connector. *Do not bend or fold the ribbon cable.*

- b) Unplug the two 7-pin connectors found on the far ends of the circuit board. **Note:** When removing the connectors pull evenly from the center of the connector, taking care not to bend the connector pins. Note the orientation of the connectors. Maintain this orientation during re-assembly.
  - c) Unplug and remove both ends of the air hose (clear tubing).
  - d) Unscrew and remove the two screws securing the board to the unit.
  - e) Carefully lift and rotate the circuit board from the unit (taking care not to unplug any of the remaining connections) so that it is resting on top of the ledge.
- 7) Rotate the filter manifold 180° such that the end of the manifold is pointing upward. Gently lift the manifold out of the unit. **Note:** The filter housing cover is attached to the manifold and will be removed *with* the manifold.
  - 8) Remove the dirty filter. Place a clean, new filter over the opening in the filter housing inside the unit (rough side without pattern faces out). Make certain the new filter is not pushed into the opening of the housing, as this will prevent the filter housing from being properly sealed.
  - 9) With the end of the manifold pointing upward, gently place the filter housing cover over the new filter.
  - 10) Rotate the filter manifold 180° until the end of the manifold is positioned downward and the tube end is pointing upward.
  - 11) Secure the filter manifold with the two screws removed from the bottom side of the unit.
  - 12) Carefully return the circuit board to its original place inside the unit, positioning it so the EXT DC & OUTPUT ports and the SENSI ADJ & 0-ADJ potentiometers are properly seated in their respective openings in the monitor case. (Make certain all existing connections on the circuit board are intact.)
  - 13) Secure the circuit board using the same two screws removed earlier in Step 6 (d).
  - 14) Re-attach the 7-pin connectors and the ribbon connector. *Be careful not to bend the pins or stress the circuit board.*
  - 15) Re-attach the air hose (clear tubing).
  - 16) Place the battery pack inside the unit.
  - 17) Plug the connector from the battery pack into the keyed receptacle on the circuit board. *Make certain the connection is secure.*
  - 18) Replace the front cover.
  - 19) Position the unit so the remaining uncovered side is facing you.
  - 20) Place a clean, new filter in the filter housing cover (rough side without pattern faces out). *Make certain the new filter rests on the rim of the cover.*
  - 21) Carefully place the filter housing cover on the filter housing. *Make certain the new filter remains in its proper position.*
  - 22) Insert one of the four screws into the filter housing cover, positioning it until it engages with the threads of the opposite filter housing cover. Turn the screw one or two turns *only* to ensure engagement. Repeat this procedure for each of the other screws. **DO NOT TIGHTEN ANY SCREWS AT THIS TIME.**
  - 23) Once all the screws are properly engaged, make certain the filter housing cover is positioned correctly on the filter housing. While applying enough pressure to the cover to maintain its position, tighten one of the four screws. Release pressure and tighten the other three screws.
  - 24) Replace the back cover. Secure the cover with the four screws removed earlier in Step 3.

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## 4.2 BATTERY MAINTENANCE

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### 4.2.1 Rechargeable Battery Pack

Recharge the nickel-cadmium batteries for 15 hours to obtain a full charge, if the battery check is below the red line on the Analog Ratemeter. The nickel-cadmium battery pack will operate either the Model LD-1 or the Model LD-1H for about 8 hours at 20° C.

To replace the battery pack do the following:

- 1) Turn the Power off. Place the unit in an upright position. Remove the battery cover (front cover) by pressing on the PUSH buttons found at each end of the unit. (It is necessary to press these buttons at the same time in order to remove the cover.)
- 2) Unplug and remove the battery pack from the unit.
- 3) Plug the battery pack connector from the new battery pack into the keyed receptacle on the circuit board.
- 4) Place the battery pack in the battery compartment. Insert a piece of foam (included) between the battery and the filter manifold to prevent the battery from moving. Replace the battery cover.

### 4.2.2 Disposable Batteries

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**NOTE**

*Use only fully charged batteries.*

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Check the charge by activating the monitor and pressing the BATT button while observing the Analog Ratemeter. The batteries are adequately charged when the needle moves to the Red Line area. Replace the batteries if the battery charge is below the Red Line on the Analog Ratemeter. Eight (8) AA batteries (standard dry cell) will operate the Laser Dust Monitor for about 10 hours at 20° C. When 4 batteries are placed in one side of the cartridge, the unit can be operated for about 5 hours.

Eight (8) AA Alkaline batteries will operate the Laser Dust Monitor for about 24 hours at 20° C. When 4 Alkaline batteries are placed in one side of the cartridge, the unit can be operated for about 12 hours at 20° C.

If the unit is not going to be used for a long period of time, remove the batteries and store them separately to protect the unit from possible damage due to battery leakage.

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**NOTE**

*ALWAYS turn the power off before removing or replacing the batteries.*

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### 4.3 AIR INLET & DETECTOR CLEANING

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The Air Sampling Inlet and Detector should be cleaned monthly during regular use.

To clean, do the following (refer to Figure 4.1):

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**NOTE**

*The fan must operate during cleaning to prevent dusted particles from re-settling on the detector surface.*

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- 1) Turn on the unit and remove the Sampling Air Inlet cover.
- 2) Remove the Sampling Air Inlet piece by turning it counter-clockwise.

- 3) Using a flashlight for illumination, locate the detector through the inlet opening. The detector is located on the left side of the opening when the monitor is facing toward you. Gently clean the detector and inner surfaces using the brush that came with the unit.

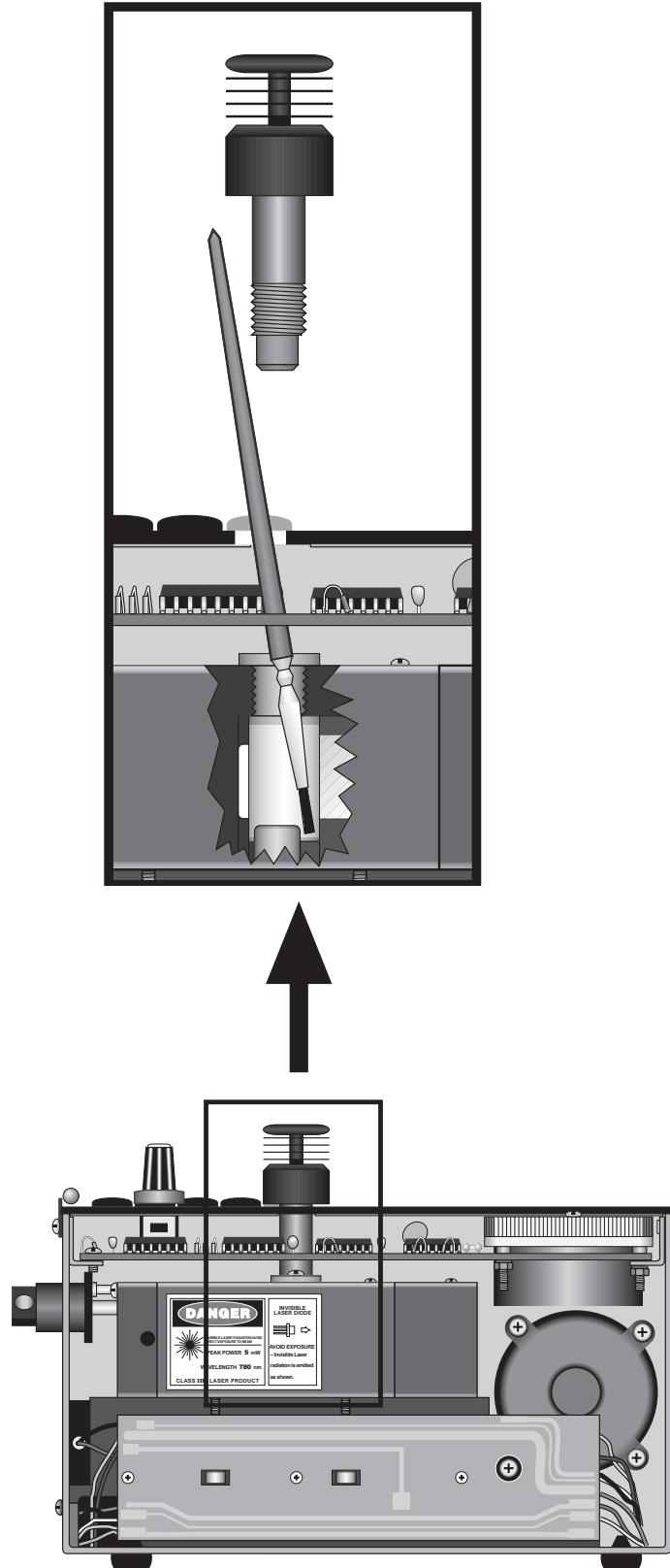
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**NOTE**

*Do not use cotton swabs or solvents to clean the Detector as they may mar the surface.*

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- 4) Clean the Sampling Air Inlet piece with the brush.
- 5) Insert the Sampling Air Inlet piece into the unit and secure it by turning clockwise.
- 6) Replace the Sampling Air Inlet cover.
- 7) Turn Off the unit.



**Figure 4.1**  
**Sampling Air Inlet & Detector Cleaning**

# APPENDIX A

## PARTS LIST

Part Number	Item/Description
7016429-1	Rechargeable Nickel-Cadmium Battery Pack
7016429-3	Battery Kit (Rechargeable Battery Pack & Adapter)
7016429-4	Battery Charger (115 VAC to 12 Vdc Adapter)
7016430	Recorder Cable
7016431	Inlet and Exhaust Tubing Connectors
7016459P	Replacement Filters (package of 6)
7016461	Soft-Bristle Cleaning Brush
7012201-1M	Operation & Service Manual



# APPENDIX B SPECIFICATIONS

Principle of Operation .....	Light scatter
Standard Particle .....	Arizona Road Dust (< 7 $\mu$ m)
Applications .....	Real-time monitoring of airborne dust, fumes, mists, and aerosols.
Measuring Range .....	LD-1: 0.01–100 mg/M <sup>3</sup> (1 CPM) LD-1H: 0.001–10 mg/M <sup>3</sup> (1 CPM)
Sensitivity .....	LD-1: 0.01 mg/M <sup>3</sup> (1 CPM) [Arizona Road Dust, fine] LD-1H: 0.001 mg/M <sup>3</sup> (1 CPM) [Arizona Road Dust, fine]
Accuracy .....	± 10% of reading (Arizona Road Dust, Fine)
Flow Rate (at inlet) .....	3.4 LPM (220 ft/min. with optional inlet adapter installed)
Sample Time .....	Five (5) ranges selectable: 0.1, 1, 2, 5, & 10 minutes Manual mode
Readout .....	Continuous/Analog (Ratemeter) LD-1: 0.01–10 mg/M <sup>3</sup> , 0.1–100 mg/M <sup>3</sup> [x10] LD-1H: 0.001–1 mg/M <sup>3</sup> , 0.01–10 mg/M <sup>3</sup> [x10]
Cumulative .....	LCD 4-digit counter, plus 5th character denoting counting in progress) Digital LCD (0–9999)
Output .....	Analog signal output for recorder (0–1 V) Pulse signal output for external counter
Temperature Range (Operation) .....	0° C to 40° C (32° F to 104° F)
Temperature Range (Storage) .....	-20° C to 60° C (-4° F to 140° F)
Power Options .....	AC/DC adapter Rechargeable Nickel-Cadmium Battery Pack Eight (8) AA batteries: Dry cell (10 hours of operation) Alkaline (24 hours of operation)
Power Requirements .....	115 VAC, 60 Hz
Size: .....	7.4 in (W) x 2.5 in (D) x 4.2 in (H) 188 mm (W) x 64 mm (D) x 107 mm (H)
Weight .....	3.3 lbs (1.5 kg)

# APPENDIX C

## TROUBLESHOOTING GUIDE

<b>Cause</b>	<b>Remedy</b>
<p>• “0” is not displayed on the LCD when Power Switch is On.</p>	
<b>Poor Contact of AC adapter.</b>	Connect AC adapter properly.
<b>Battery exhausted.</b>	Replace battery.
<b>Breaker actuated.</b>	Reset breaker. (If actuates again, return unit for repair.)
<p>• S-value cannot be adjusted to <math>\pm 10\%</math> of the value listed on the Test Report.</p>	
<b>Decline of sensitivity due to detector contamination.</b>	Clean detector or return unit for repair.
<b>Battery exhausted.</b>	Recharge or replace battery.
<b>Aging of laser diode.</b>	Adjust laser properly or return unit for repair.
<b>Improper Sensivity Adjustment Knob setting.</b>	Adjust properly.
<b>Sensitivity declined to 10% of normal value.</b>	Cancel “x10” mode.
<p>• LED on zero adjustment button blinks on and off when button is activated.</p>	
<b>0-ADJ potentiometer is turned counterclockwise too much.</b>	Set Sensitivity Adjustment Knob to MEASURE and turn 0-ADJ potentiometer clockwise.
<p>• Ratemeter is off-scale below zero.</p>	
<b>Poor zero adjustment.</b>	Set Sensitivity Adjustment Knob to MEASURE and turn 0-ADJ potentiometer clockwise.
<p>• Ratemeter is off-scale above 10 mg/M3 (LD-1) or 1 mg/M3 (LD-1H).</p>	
<b>Poor sensitivity adjustment.</b>	Set Sensitivity Adjustment Knob to SENSI ADJ and turn SENSI ADJ potentiometer counterclockwise. Then conducty zero and sensitivity adjustments. If problem is not resolved, return unit for repair.

# APPENDIX D RETURNED MATERIAL AUTHORIZATION

Sensidyne, Inc. maintains an instrument service facility at the factory to provide its customers with both warranty and non-warranty repair service. Sensidyne, Inc. assumes no liability for service performed by personnel other than Sensidyne, Inc. personnel. To facilitate the repair process, please contact the Sensidyne Service Department in advance for assistance with a problem which cannot be remedied and/or requires the return of the product to the factory. All returned products require a Returned Material Authorization (RMA) number. Sensidyne Service Department personnel may be reached at:

**SENSIDYNE, INC.**  
**16333 Bay Vista Drive**  
**Clearwater, FL 33760 USA**  
**800-451-9444**  
**727-530-3602**  
**727-539-0550 [FAX]**

All non-warranty repair orders will have a minimum fee whether the repair is authorized or not. This fee includes handling, administration and technical expenses for inspecting the instrument and providing an estimate. However, the estimate fee is waived if the repair is authorized.

If you wish to set a limit to the authorized repair cost, state a "not to exceed" figure on your purchase order. Please indicate if a price quotation is required before authorization of the repair cost, understanding that this

invokes extra cost and handling delay. Sensidyne, Inc.'s repair policy is to perform all needed repairs to restore the instrument to its full operating condition.

Repairs are handled on a "first in - first out" basis. Your order may be expedited if you authorize an expediting fee. This will place your order next in line behind orders currently in process.

Pack the instrument and its accessories (preferably in their original packing) and enclose your return address, purchase order, shipping and billing information, RMA number, a description of the problem encountered with your instrument and any special instructions. All prices are subject to change without notice.

If this is the first time you are dealing directly with the factory, you will be asked to prepay or to authorize a COD shipment.

Send the instrument, prepaid, to:

**SENSIDYNE, INC.**  
**16333 BAY VISTA DRIVE**  
**CLEARWATER, FL 33760 USA**

**ATTENTION: Service Department**

**RMA #:** \_\_\_\_\_

## SERVICE OPTIONS

The Sensidyne Service Department offers you a variety of service options which will help increase your user confidence while minimizing costly interruptions and maintenance costs. These options include initial training, on-site technical assistance, and full factory repairs. Sensidyne has developed several programs which will allow you to select just the right options best suited to your applications and needs. For further information, contact the Sensidyne Service Department.