

**FLUKE®**

**Biomedical**

# **Nuclear Associates 07-443**

## **Clamshell Densitometer**

**Users Manual**

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# Table Of Contents

Section 1:	<b>General Information</b> .....	<b>1-1</b>
1.1	Product Description .....	1-1
1.2	Specifications.....	1-2
Section 2:	<b>Operation</b> .....	<b>2-1</b>
2.1	Zeroing the Unit .....	2-1
2.2	Making a Measurement .....	2-1
2.3	Receiving Inspection.....	2-2
2.4	Storage .....	2-2
2.5	Battery Installation/Replacement .....	2-2
2.6	Display .....	2-3
2.7	Controls .....	2-3
2.8	Routing Cleaning .....	2-4
Section 3:	<b>Maintenance/Calibration</b> .....	<b>3-1</b>
3.1	Calibration Check .....	3-1
3.2	Step Table Accuracy.....	3-1
3.3	Maintenance .....	3-2
3.4	Recommended Spare Parts.....	3-3



## Section 1 General Information

### 1.1 Product Description

The Model 07-443 Densitometer is designed to measure transmission density per ANSI specification PH2.19-1986. The unit's high accuracy and reliability allow precise and repeatable measurement to be made quickly and easily with very little operator training. In addition, due to its solid-state design and rugged construction, the Model 07-443 requires a minimum amount of maintenance. By using the 07-443 Densitometer, readings of optical density for film media can be obtained directly, accurately, and reproducibly.

The 07-443 Densitometer features a rugged aluminum bottom casting, which houses four (4) AA batteries and the detector light source. The top section of the Densitometer holds the 3 1/2 digit display, ON/OFF push-button, and the READ, LAMP, and ZERO push-buttons. Refer to Figure 1-1 for a general view.

A 1 mm aperture is included as an accessory with the instrument. When changing apertures, the instrument must be readjusted to zero by using the zero adjustment potentiometer located on the side of the instrument.



Figure 1-1. Model 07-443 Densitometer

## 1.2 Specifications

<i>Density Range:</i>	0 - 4.00 Density
<i>Accuracy:</i>	$\pm 0.02$ D over specified range
<i>Reproducibility:</i>	$\pm 0.01$ D
<i>Operating Conditions:</i>	50° F to 104° F (10° C to 40° C) Maximum 90% Relative Humidity (non-condensing)
<i>Aperture:</i>	2 mm (1 mm Accessory)
<i>Measuring Length:</i>	5.3 inches (135 mm)
<i>Display:</i>	3 Digit 1/2 inch LCD, w/Polarity and Low Battery Indicator
<i>Zero Range:</i>	Auto zeroes up to density 1.00 D
<i>Sensor:</i>	20 R/sec High Efficiency Silicon Photodiode
<i>Controls:</i>	Zero: Push-button; automatically zeroes unit
<i>Power:</i>	ON/OFF push-button turns unit power on/off
<i>Calibration Control:</i>	Screwdriver adjustment; 20 turn potentiometer used to calibrate against a know step tablet.
<i>READ Push-button:</i>	Initiates read sequence
<i>LAMP Push-button:</i>	Turns light source on for three (3) seconds
<i>Light Source:</i>	Ultra bright lamp turns on during measurement; provides extremely long life with minimal spectral and intensity degradation; reduces specimen heating to a minimum.
<i>Dimensions (H x W x D):</i>	2.40 x 3.20 x 7.10 in. (61 x 81 x 180 mm)
<i>Weight:</i>	1.72 lbs. (78 g)
<i>Power:</i>	Four (4) 1.5 V AA Batteries
<i>Supplied Accessory:</i>	Part No. 010128, 5 step precision wedge Part No. 166055, 1 mm Aperture
<i>Certification:</i>	Designed to measure diffuse transmission density per ANSI specification PH 2-19-1986

## Section 2 Operation

### 2.1 Zeroing the Unit

Each time the Model 07-443 Densitometer is turned ON, and before a measurement is made, it must be zeroed to ensure accurate measurements. Use the following procedure:

1. Press the ON/OFF push-button to turn the unit on.
2. Gently close the top section of the Densitometer until the Photo Head touches the aperture.
3. Holding the unit in the closed position, press the ZERO button once and wait until the display reads 0.00.
4. Slowly allow the top section of the unit to return to the open position.
5. Should the unit complete the Auto-Zero sequence and show a value either slightly higher or lower than 0.00, it may be necessary to manually adjust the display to obtain a reading of 0.00. The Zero Adjustment Pot, located along the right edge of the unit, is used for this purpose.

The zeroing procedure also allows the BASE/FOG value to be subtracted from all subsequent measurements as follows:

1. Press the ON/OFF push-button to turn the unit on.
2. Place the BASE/FOG area over the aperture.
3. Gently close the top section of the unit until the photo head and the aperture are pressed tightly against the film.
4. Holding the unit in the closed position, press the ZERO button and wait until the display reads 0.00.
5. Slowly open the unit.

The zero reference is now set to the BASE/FOG value. Subsequent measurements will be made with respect to the BASE/FOG value.

### 2.2 Making a Measurement

1. Push the ON/OFF button to turn the unit on.
2. Zero the instrument (refer to Zeroing the Unit, step 2 through 4).
3. With a piece of film media or step wedge in hand, press the LAMP button. The lamp in the bottom casting will turn on and stay on for about three (3) seconds.
4. Place the film media or step wedge on the light table and position the area to be measured over the aperture (refer to Figure 2-1).

NOTE
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Press the LAMP Button as necessary to keep the lamp illuminated.

5. When the film is in position, gently close the top section of the unit until the photo head and aperture are pressed tight against the film.
6. Press the READ button. The measured density will be displayed.
7. Slowly allow the top section of the unit to return to the open position.
8. Remove the film media or step wedge.
9. Repeat steps 3 through 8 as required to make additional measurements.



*Figure 2-1. Aperture Location*

## **2.3 Receiving Inspection**

Upon receipt of the unit:

1. Check the shipping carton (s) and their contents for in-shipment damage. If damage is evident, file a claim with the carrier and contact Fluke Biomedical at 440.498.2564, or by Fax at 440.542.3682 immediately.
2. Check that all items listed on the packing slip are present and in good condition. If any items are missing or damaged, contact Fluke Biomedical at 440.498.2564, or by Fax at 440.542.3682.

## **2.4 Storage**

If the unit is to be stored prior to use, pack it in the original container (s) if possible, and store in an environment free of corrosive materials, fluctuations in temperature and humidity, and vibration and shock.

## **2.5 Battery Installation/Replacement**

Use the following procedure to install/replace batteries.

NOTE



A LOW BAT indicator will be displayed when the batteries need to be replaced. This indicator may flash briefly when a READ sequence is initiated; however, the batteries need replaced only if the indicator remains on for several seconds.

1. Remove the four (4) screws securing the battery cover on the bottom of the aluminum casting of the densitometer.
2. If applicable, remove the used batteries.
3. Insert four (4) fresh AA alkaline batteries, being careful to observe proper polarity.
4. Replace and secure the cover, using the four (4) screws removed in step 1.

NOTE

When battery installation/replacement is complete, be sure all hardware is back to its original place, and all screws are tight.

## 2.6 Display

Density measurements are displayed on a 3 digit 1/2 in. LCD, featuring polarity and low battery indications.

## 2.7 Controls

The Densitometer controls include an ON/OFF push-button (turns unit on/ off), a ZERO push-button (automatically zeroes the unit), a LAMP Push-button (turns light source on for three (3) seconds), a READ Push-button (initiates read sequence), Calibration Control, and Zero Adjustment. The Calibration Control is a screwdriver adjustment for a 20-turn potentiometer that is used to calibrate against a known step table. The Zero Adjustment pot is used to manually set the Auto-Zero for a reading of 0.00. Refer to Figure 1-1.

## 2.8 Routine Cleaning

CAUTION

Do not immerse the Model 07-443. The unit is not waterproof. Liquid could damage the circuits. The unit should be kept clean and free from dirt and contamination. The unit may be cleaned by wiping with a damp cloth using any commercially available cleaning or decontaminating agent.

Keep the underside of the photohead clean using alcohol and a soft cloth as required. DO NOT USE, under any circumstances, any other solvent.



## Section 3 Maintenance/ Calibration

### 3.1 Calibration Check

It is a good practice to perform a calibration check on the Densitometer at least once every two (2) weeks, **(more or less depending on the frequency of use of the unit)**. Use the following procedure:

1. Zero the instrument (refer to Section 3 -Operation).
2. Place step # 4 of the supplied precision step wedge over the aperture.
3. With the wedge in position, gently close the top section of the unit until the Photo Head and the Aperture are pressed lightly against the wedge.
4. Press the READ button. The measured density will be displayed.
5. Slowly allow the top section of the unit to return to the open position.
6. Remove the step wedge.
7. Compare the density displayed in step 4 to the stated density on the step wedge.
8. Using a screwdriver, adjust the potentiometer (accessible from the right hand side of the top section of the unit) until the reading displayed matches the stated density.
9. Press the READ button and wait for a reading. Repeat for each change in the calibration potentiometer.

### 3.2 Step Table Accuracy

For quality control purposes, the calibration of the instrument with the supplied step tablet is sufficient. However, it should be noted that the slope of the indicated density curve will change if any color shifts are caused by the materials being measured. Although the light source is close to the ANSI standard of typical response of the human eye, it is not exact. Therefore, films that produce a spectral shift may produce consistently higher or lower density readings. In such cases, a calibrated step wedge of the same material as being measured is necessary to adjust instrument calibration.

## 3.3 Maintenance

**WARNING**

This instrument contains CMOS integrated circuits. Static charge normally present in a dry environment or leakage current in soldering irons, or other non-grounded tools can instantly destroy CMOS components. Do not attempt to remove or replace ICs in this device without observing anti-static and leakage current precautions. Service should be performed only by a technician thoroughly familiar with CMOS devices.

As with any precision measurement instrument, certain precautions and periodic maintenance procedures are necessary:

1. Keep the underside of the photohead clean, using alcohol and a soft cloth as required. Do not use, under any circumstances, any other solvent.
2. Periodically check the alignment of the aperture and the photo head. Misalignment may be due to:
  - a. Dropping the instrument.
  - b. Using excessive pressure to hold the instrument closed.
  - c. Letting the top section "slam" in the open position.

### LAMP REPLACEMENT

Use the following procedure to replace the lamp:

1. Remove the four (4) screws securing the cover on the bottom of the aluminum casting of the densitometer.
2. Remove the cover to gain access to the pc board underneath.
3. Remove the two (2) screws holding the printed circuit board to the casting.
4. Remove the printed circuit board to gain access to the lamp.
5. Unsolder the used lamp.
6. Insert and solder the new lamp in place.

**CAUTION**

Too much heat from a solder iron can damage the lamp. A 15-watt iron is recommended.

7. Replace and secure the printed circuit board to the casting using the two (2) screws removed in step 3.
8. Replace and secure the cover, using the four (4) screws removed in step 1.

**NOTE**

When lamp replacement is complete, be sure all hardware is back to its original place on the instrument. Also, be sure all screws are tight and all washers are properly positioned.

NOTE

If the photo head and the aperture are out of alignment, contact Fluke Biomedical at 440.498.2654 or by Fax 440.542.3682.

### 3.4 Recommended Spare Parts

Recommended spare parts are shown below:

<u>Description</u>	<u>Part Number</u>	<u>Quantity</u>
AA Alkaline Battery	750003	4
5 Step Calibration Tablet	010128	1
5 Step Calibration Tablet Label	010093	1
Lamp	680041	2
1 mm Aperture	166055	2
2 mm Aperture	166060	2

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