

FLUKE®

Biomedical

Nuclear Associates 37-443

Radiochromic Densitometer with Film Transport System

Operators Manual

**Fluke Biomedical
Radiation Management Services**

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Section 1 Introduction

1.1 Product Description

The Model 37-443 Radiochromic 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 37-443 requires a minimum amount of maintenance. The Model 37-443 incorporates a bandpass filter (660 nm bandpass ± 2 nm) to match the spectrum for GAFCHROMIC™ media. By using the 37-443 Radiochromic Densitometer, readings of optical density for GAFCHROMIC media can be obtained directly, accurately, and reproducibly. The 37-443 Radiochromic 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 ½ digit display, power switch, and the READ, LAMP, and ZERO control switches. Refer to Figure 1-1 for a general view.

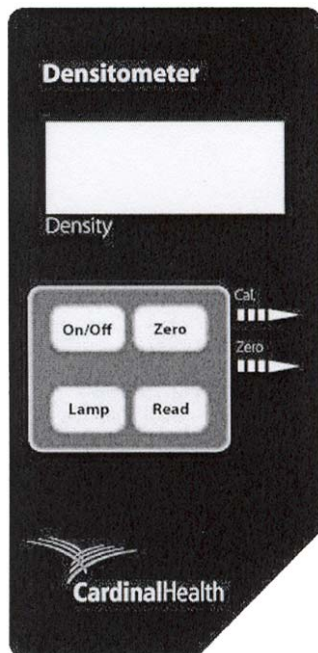


Figure 1-1. Model 37-443 Radiochromic Densitometer

1.2 Specifications

Density Range	0 - 4.00 Density
Accuracy	± 0.02 D over specified range
Reproducibility	± 0.01 D
Operating Conditions	50°F to 104°F (10°C to 40°C) Maximum 90% relative humidity (non-condensing)
Aperture	2 mm
Measuring Length	5.3 in (135 mm)
Display	3-digit ½ inch LDC, with polarity and low battery indicator
Zero Range	Auto zeroes up to density 1.00 D
Sensor	High efficiency silicon photodiode
Control	Zero: Push-button; automatically zeroes unit Power: ON/OFF switch turns unit power ON/OFF Calibration Control: Screwdriver adjustment, 20-turn potentiometer used to calibrate against a know step tablet. READ Push-button: Initiates read sequence LAMP Push-button: Turns light source on for three seconds
Light Source	Ultra bright LED, peak wavelength 660 nm, turns on during measurement; provides extremely long life with minimal spectral and intensity degradation; reduces specimen heating to a minimum.
Bandpass Filter	10 nm bandwidth centered at 660 nm ± 2 nm
Dimensions (H x W x D)	2.40 x 3.20 x 7.10 in (61 x 81 x 180 mm)
Weight	1.72 lb (780 g)
Power	Four (4) 1.5 V AA alkaline batteries
Supplied Accessory	P/N 010128, 3 step precision wedge
Certification	Designed to measure diffuse transmission density per ANSI specification PH2.19-1986
Routine Cleaning	

CAUTION

Do not immerse Model 37-443 Radiochromic Densitometer. The unit is not waterproof. Liquid could damage the circuits. The unit should be kept clean and free of dirt and contamination. The unit may be cleaned by wiping with a damp cloth using any commercially available cleaning or decontaminating agent.

CAUTION

Keep the underside of the photo head clean using alcohol and a soft cloth as required. Do not use under any circumstances, any other solvent.

1.3 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, Radiation Management Services at 440.248.9300 immediately.
2. Check that all items listed on the packing slip are present and in good condition. If any items are missing damaged, contact Fluke Biomedical at 440.248.9300.

1.4 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.

1.5 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.

1.6 Display

Density measurements are displayed on a 3-digit V2 in LCD, featuring polarity and low battery indications.

1.7 Controls

The Radiochromic Densitometer controls include an ON/OFF switch (turns unit on/off), a ZERO push-button (automatically zeroes the unit), a LAMP Push-button (turns light source on for three 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.

Section 2 Operation

2.1 Zeroing the unit

Each time the Model 37-443 Radiochromic Densitometer is turned ON, and before a measurement is made, it must be zeroed to ensure accurate measurements. Use the following procedure:

1. Turn the Power Switch 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 switch 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.
6. 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. Turn the Power Switch ON.
2. Zero the instrument (refer to Section 2.1, Zeroing the Unit, step 2 through 4).
3. With a piece of GAF Chrome dosimetry 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 seconds.
4. Place the GAF Chrome dosimetry media or step wedge on the light table and position the area to be measured over the aperture (refer to Figure 2-1).

NOTE

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 GAF Chrome dosimetry media or step wedge.
9. Repeat steps 3 through 8 as required to make additional measurements.



Figure 2-1. Aperture Location

Section 3

Calibration and Maintenance

3.1 Calibration Check

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

1. Zero the instrument (refer to Section 2, Operation).
2. Place step 2 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 2 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 table 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. The light source consists of a red LED with a peak wavelength of 660 nm. A bandpass filter mounted above the LED provides a 10 nm bandwidth centered at 660 nm \pm 2 nm.

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 photo head 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 one of the following:
 - a. Dropping the instrument
 - b. Using excessive pressure to hold the instrument closed
 - c. Letting the top section "slam" in the open position

NOTE

If the photo head and the aperture are out of alignment, contact Fluke Biomedical at 440.248.9300.

3.4 Recommended Spare Parts

Recommended spare parts are shown below:

<u>Description</u>	<u>PIN</u>	<u>Quantity</u>
AA Alkaline Battery	750003	4
5 Step Calibration Tablet	010128	1
5 Step Calibration Tablet Label	010093	1

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