

**Model FC2B  
UltraRadiac™ and  
UltraRadiac™-Plus  
Calibration Check Unit**

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**User's Manual**



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# Notes

# 1. Check Source Precautions

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**CAUTION** This procedure uses radioactive material (the check source). Introduction of which into foods, beverages, cosmetics, drugs, or medicinals, or into products manufactured for commercial distribution is prohibited. Quantities should not be combined.

Please consult your local and national regulatory agencies for more specific regulatory information.

## Handling

Though the weakly radioactive check source used in the FC2B doesn't require special handling, it would be prudent to avoid eating, drinking, smoking and the application of cosmetics while handling it.

## Use

Handling radioactive material, even one as weak as the FC2B check source, carries some risk. To help keep exposure low, you should maximize your distance from the source, minimize your time of exposure and shield yourself from the radiation source.

Radioactive materials should be used only as intended, only by responsible persons, only in authorized areas, and always according to instructions.

## Storage

Because of the check source's low level of activity, it can be safely stored in the FC2B unit.

Radiation safety requires that the door-lock screw be used to lock the FC2B's door when not in use.

## 2. Calibration Check Procedure

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Using the FC2B with its built-in  $^{137}\text{Cs}$  calibration check source, the UltraRadiac™ Personal Radiation Monitor can check its own calibration by adjusting the factor which corrects its response to a known radiation field intensity.

### Checking the Calibration Factor

Before starting the calibration check process, ensure that:

- The UltraRadiac is OFF.
- The FC2B's door-lock screw has been removed so the door can open (Figure 1).



Figure 1 FC2B with Door Lock Screw Removed

## Performing the Calibration Check

1. While pressing and holding both the RATE key and the CLR/TEST key, press and release the ON/OFF key. When three horizontal bars appear on the display, release the RATE and CLR/TEST keys.
2. Press RATE key once. The original Calibration Factor, a flashing number between 1.00 and 2.00 will be displayed. These limits represent an ideal unit having a Calibration Factor of  $1.50 \pm 33\%$ .
3. Press the RATE key again to see the flashing Calibration Set Point.
4. If the unit is an UltraRadiac, determine if it was manufactured in 2007. (The GM tubes in UltraRadiacs manufactured in 2007 were installed at a different height and so require a separate calibration set point.) The UltraRadiac serial number contains the month and year in which the unit was manufactured. The first two digits of the serial number are the month of manufacture. The next two digits are the year of manufacture. So, 0905xxxx is the serial number of a unit manufactured in September, 2005. 1107xxxx is the serial number of a unit manufactured in November, 2007. If an UltraRadiac was manufactured in 2007, it uses the second calibration set point label, the one which reads, "2007 CAL SET POINT". All other UltraRadiacs and all UltraRadiac-Plus units use the first set point label. See Figure 2 below.
5. To change the Calibration Set Point to its original value, press the CLR/TEST key.
6. The display's radiation unit, at the right side of the display, and the decimal point will flash.
7. Press the RATE key repeatedly until the radiation unit and the location of the decimal point match those on the FC2B's Calibration Label. For example, the label in Figure 2 shows a set point of 8.58 mR/hr for UltraRadiacs manufactured in 2007, and 10.60 mR/hr for all others (including all UltraRadiac-Plus units).\*

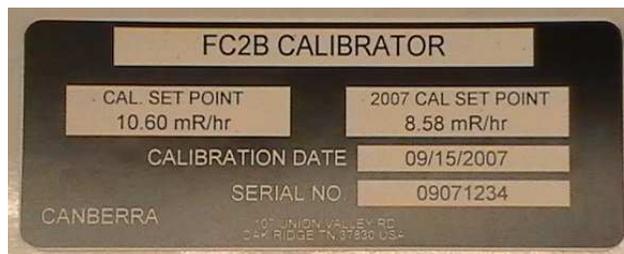


Figure 2 A Typical Calibration Label

\* Because of the natural decay of the FC2B's check source, the Calibration Set Point on the label is correct only for the first year. To correct for the check source's age, refer to "Decay Time Correction" on page 5.

## Chapter 2 Calibration Check Procedure

8. Press the CLR/TEST key. The first (leftmost) digit will begin to flash.
9. Read on the FC-2B the appropriate Calibration Set Point.
10. Press the RATE key repeatedly until the value of the first digit matches the first digit in the FC2B's appropriate Calibration Set Point value.
11. Press the CLR/TEST key. The next digit will begin to flash.
12. Repeat steps 10 and 11 to match each of the remaining digits with the values on the FC2B's appropriate Calibration Label.
13. When the last digit has been set, you'll see **020** or **030** in the display, depending on the release version of your UltraRadiac or UltraRadiac-Plus. This represents the start of a 20 or 30 second countdown.
14. Open the FC2B's door and slide the UltraRadiac, display end first and facing up, into the FC2B.



Figure 3 FC2B With UltraRadiac Inserted

15. When the countdown reaches **000**, the unit will begin acquiring radiation data.
16. After about two minutes data acquisition will end, an audible alarm will sound. This indicates that calibration is complete.
17. Remove the UltraRadiac from the FC2B. The flashing display will show the new Calibration Factor.

18. A blinking Calibration Factor indicates that the new factor is within 33% of the reference point. Turn the unit off; the calibration is complete.
19. If the blinking Calibration Factor alternates with a dashed line above or below the factor, the UltraRadiac is out of tolerance. Go back to step 1 and verify that you matched the UltraRadiac's radiation units, decimal point location and three-digit value with the appropriate set point on the FC2B's Calibration Label.
20. If you find that the data was entered correctly, your UltraRadiac must be repaired; contact your local Mirion Service Center.
21. Relock the FC2B's door with the door-lock screw.



**CAUTION** Radiation safety requires that the door-lock screw be used to lock the FC2B's door when not in use.

## Decay Time Correction

The FC2B check source's radiation declines a little every year; half of it will be gone in 30 years (the source's "half life"). To obtain a more accurate calibration, you should correct the FC2B's Calibration Set Points for the source's age.

Using the table on the next page, find the age of the check source (to the nearest year) and multiply the FC2B's Set Points by the table's Decay Time Correction Factor.

### An Example Correction

To correct a three-year old check source:

FC2B Original Calibration Set Point.....	10.60
Multiply by the 3-year Decay Correction .....	<u>0.933</u>
Corrected Calibration Set Point.....	9.89

For a 3 year old check source, the Corrected Calibration Set Point, 9.89, would be used in step 7 of the procedure instead of the value on the Calibration Label.

<b>Decay Time Correction Factor</b> <b>(Half-Life of <math>^{137}\text{Cs}</math> = 30.17 Years)</b>	
<b>Check Source's Age in Years</b>	<b>Correction Factor</b>
1	0.977
2	0.955
3	0.933
4	0.912
5	0.891
6	0.871
7	0.851
8	0.832
9	0.813
10	0.795
11	0.777
12	0.759
13	0.742
14	0.725
15	0.708
16	0.692
17	0.677
18	0.661
19	0.646
20	0.629
21	0.615
22	0.601
23	0.588
24	0.574
25	0.561
26	0.550
27	0.538
28	0.526
29	0.514
30	0.502

# A. Specifications

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## Physical

**DIMENSIONS** – 16.8 x 14.0 cm (6.6 x 5.5 in.) H x D; height includes the carrying handle.

**WEIGHT** – 5.4 kg (12 lb).

**CONSTRUCTION** – All aluminum, with hinged access door.

## Calibration

**CHECK SOURCE** – The FC2B includes a  $^{137}\text{Cs}$  8 uCi check source used to calibrate the instrument's response. Within the instrument's environmental specifications, the response is linear up to 350 R/h (3.5 Sv/h)  $\pm 15\%$ , and within  $\pm 20\%$  of the actual dose rate from 350 R/h (3.5 Sv/h) to 500 R/h (5.0 Sv/h).

**CALIBRATION DATA** – The check source's calibration data and its date of manufacture are listed on the Calibration Label on top of the FC2B.

**POSITIONING** – When the instrument is inserted into the FC2B's side opening, the check source mounted in the opening's bottom surface will be opposite the instrument's Geiger-Mueller detector.



## Warranty

Mirion Technologies (Canberra) Inc. (we, us, our) warrants to the customer (you, your) that for a period of ninety (90) days from the date of shipment, software provided by us in connection with equipment manufactured by us shall operate in accordance with applicable specifications when used with equipment manufactured by us and that the media on which the software is provided shall be free from defects. We also warrant that (A) equipment manufactured by us shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment of such equipment, and (B) services performed by us in connection with such equipment, such as site supervision and installation services relating to the equipment, shall be free from defects for a period of one (1) year from the date of performance of such services.

If defects in materials or workmanship are discovered within the applicable warranty period as set forth above, we shall, at our option and cost (A) in the case of defective software or equipment, either repair on a return to factory basis or replace the software or equipment, or (B) in the case of defective services, reperform such services.

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### EXCLUSIONS

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We are under no obligation to provide warranty service if adjustment or repair is required because of damage caused by other than ordinary use or if the equipment is serviced or repaired, or if an attempt is made to service or repair the equipment, by other than our Service Personnel without our prior approval.

Our warranty does not cover detector damage due to neutrons or heavy charged particles. Failure of beryllium, carbon composite, or polymer windows or of windowless detectors caused by physical or chemical damage from the environment is not covered by warranty.

We are not responsible for damage sustained in transit. You should examine shipments upon receipt for evidence of damage caused in transit. If damage is found, notify us and the carrier immediately. Keep all packages, materials and documents, including the freight bill, invoice and packing list.

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