

**West Valley Site Management Program
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Procedure for the Retained Premises**

RP-RPP013.00

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**SUBJECT: Ludlum 2241-2 Ratemeter/Scaler, Operation Procedure
for the Retained Premises**

RP-RPP013.00

1.0 PURPOSE

This document identifies the operating and maintenance requirements for the Ludlum 2241-2 Ratemeter/Scaler, and provides direction in the proper use and handling of the instrument probe when taking radiation measurements.

2.0 SCOPE

This procedure provides a general description of the Ludlum 2241-2 Ratemeter/Scaler, along with detailed instructions for its operation using a Ludlum 44-9 pancake Geiger-Mueller (GM) probe. This procedure also identifies the calibration and operability checks that must be performed to ensure the instrument's operability and accuracy.

3.0 GENERAL

3.1 Instrument Description

The Model 2241-2 is a lightweight, portable, digital ratemeter and scaler designed for use with scintillation, Geiger-Mueller (GM) and proportional detectors. The unit is operated with two "D" cell batteries. Data readout is presented on a four-digit (six digit in scaler mode) liquid crystal display (LCD) with a moving decimal point. The display units are auto-ranging, enabling the readout to display a broad range of radiation activity. The three-position switch labeled "Off/Ratemeter/Scaler" selects the desired operating mode. A locking toggle switch labeled "DET 1" and "DET 2" allows for quick changes between operating parameters (i.e., high voltage, etc.) for preset detectors. The pull-and-change toggle protects against inadvertent changes during use.

Programmable display units are set to counts per minute (cpm) in the ratemeter mode, but can be configured to read in Roentgens per hour (R/hr) or counts per second (cps). Other features include: dead-time correction (DTC) to compensate for detector dead time; audible click-per-event divided by a programmable factor of 1, 10, 100 and 1000; an LCD backlight with programmable "ON" time; programmable fixed or variable response time; and count overflow visual alarm, indicating the count circuitry is nearing the maximum counting capacity.

The Model 2241-2 incorporates independent adjustable alarms that can be set for use in either the ratemeter or scaler modes. The ratemeter mode has two alarm indicators. The first level is indicated by the word "ALERT" on the LCD. The second-level alarm is indicated by the word "ALARM," and a continuous, audible tone. The scale-mode alarm will also display the word "ALARM" and produce an audible tone. Both of the audible alarms can be silenced by depressing the "RESET" switch.

4.0 PROCEDURE

4.1 Operation

NOTE: *The following switches are to be set by the instrument user. The settings for some switches depend upon the type of detector and radiological survey being performed.*

- **OFF/RATEMETER/SCALER Switch:** Used to apply power to the meter in the selected counting mode (ratemeter or scaler).
- **AUD ON/OFF Switch:** Enables or silences the audible click per event mode.
- **F/S (Fast/Slow) Response Switch:** Used to select the meter response time. "F" is selected for fast response (one to 10 seconds) or "S" for slow (one to 30 seconds). Response times are automatically calculated based on incoming cps. The Slow response ("S") is set at five times the calculated fast response.
- **LIGHT (LCD back-light):** Push-button switch used to illuminate the LCD for a preprogrammed time interval.
- **RESET Pushbutton Switch:** Resets audible alarms. In nonalarm conditions, depressing the RESET switch resets the Ratemeter display to the minimum display readout.
- **DET 1/DET 2:** A locking toggle switch to allow changing between two preset detector setups. DET 1 is set for the 44-9 GM probe.
- **Scaler Count Switch:** A push-button switch located in the end of the carrying handle which, when depressed, initializes the start of the scaler count accumulation for the preset scaling time. The switch is only applicable when the OFF/RATEMETER/SCALER switch is set to the SCALER position.

4.2 Preoperational Check

Preoperational checks must be performed prior to each use of the instrument and should be performed periodically during extended use.

4.2.1 Battery Check and Replacement

The instrument has two "D" batteries installed. To test the batteries:

- Turn the control switch to the "Ratemeter or Scaler" position. If the meter's LCD display initializes and reads counts without a battery icon present in the lower-left corner of the LCD, then the batteries are charged and operational. When the batteries need to be replaced, either the display will not initialize or the battery icon will be present.
- Document the results of the battery check on the Instrument Preoperational Checks Log (see Attachment A).

To replace the batteries:

- Turn the instrument power switch to the "off" position.

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- Open the battery lid on the top of the case by turning the quarter-turn thumb screw counterclockwise.
 - Install two “D” batteries. The batteries are installed in opposite directions as indicated by the polarity (+) and (-) marks inside the battery door. Close and latch the battery lid.
 - Turn the control switch to the “Ratemeter or Scaler” position. The display will go through an initialization sequence and finish by showing the minimum value for ratemeter mode “00.0” or “0” in scaler mode. The battery icon will not be present in the lower left corner of the LCD.
 - After replacement, on the Instrument Preoperational Checks Log (Attachment A), note the date that the batteries were changed.

4.2.2 Radioactive Check Source Response Check

Turn the instrument to ratemeter mode and note that a background count rate is present (e.g., typically 23 to 60 cpm outside radiation areas). Expose the detector to the associated radioactive check source. Response readings should fall into the posted source check range shown on the side of the 2241-2 meter for the selected detector and source.

To source-check the detector and ratemeter:

- Hold the probe approximately one centimeter from the source. Wait the appropriate time for the meter dial to stabilize.
- Verify that the meter reads within the posted acceptable range.
- If an unacceptable response is observed, press the “RESET” button, check to see that the probe is centered on the source and that the source is within one centimeter of the probe surface.
- If an unacceptable reading is observed, do not use the instrument.
- Record the source ID and source check results on the Instrument Preoperational Checks Log (Attachment A). Return the instrument to the WVSMP Radiation Safety Officer (RSO) for repair.

4.2.3 Instrument Calibration Check

Verify that a valid calibration sticker is affixed to the instrument. Instruments will be calibrated in accordance with *Instrument Calibration for the Retained Premises*, RP-RPP011. The sticker should identify: the date the meter was calibrated, the due date for the next calibration, the initials of the calibrator and the instrument’s serial number. If the calibration has expired, or the sticker is missing, do not use the instrument and notify the WVSMP RSO.

Record the calibration due date from the calibration check on the Instrument Preoperational Checks Log (Attachment A).

Completed log forms will be filed by the NYSERDA RSO in the WVSMP Central files (Central File No. 40101-0902).

4.3 Instrument Operation

Only radiation-worker trained individuals are permitted to operate the instrument for routine or required surveys.

4.3.1 Mode Selection

4.3.1.1 Ratemeter Mode should be selected for most field survey activities using survey probes such as the 44-9 GM probe.

4.3.1.2 Scaler Mode is used to accumulate counts over a preset period of time. This mode should be selected when more accurate measurements are required from selected locations or materials.

4.3.2 Field Operation

- Perform and record all preoperational checks as described above.
- Prior to surveying items and entering an area of unknown contamination levels, set the meter to Ratemeter mode, select the "F" toggle setting and toggle the Audio switch to "ON." Enter the area or begin the survey by taking initial readings, holding the instrument probe in a given location for at least two seconds. Unless set otherwise (e.g., during calibration by trained technicians), the 2241-2 automatically calculates the response time based on the incoming cps. If the meter does not respond (i.e., no numerical value or a frozen value is shown on the readout), depress the "RESET" button and wait another few seconds until a reading is observed.
- Listen for and observe the meter readings as the instrument probe is moved over the materials or surfaces being surveyed. When large changes are observed, stop and hold the instrument probe at the location until a more stable reading is observed.
- Avoid dropping the instrument or subjecting it to severe shock.
- If the instrument malfunctions, fails operability checks, or displays erratic readings, discontinue use and notify the NYSERDA RSO.

5.0 ATTACHMENT

Attachment A: Instrument Preoperational Checks Log, one page.

ATTACHMENT A

INSTRUMENT PREOPERATIONAL CHECKS LOG

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INSTRUMENT PREOPERATIONAL CHECKS LOG

Instrument Type: (Bicron MicroRem or Ludlum 2241-2 w/GM probe)	Serial Number	Date/ Time	Radiation Worker Performing Tests (INITIALS)	Battery Check OK? (Y/N)	HV Test OK? (Y/N)	NYI Source Check Results (CPM or μ Rem/hr)	Source Check within range? (Y/N)	Calibration Due date (MM/YY)	Comments (i.e., batteries replaced, issues, repair required, etc.)

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