

NFG: No response - Dead batteries

## Eberline E140-N Calibration Worksheet

Location: Radiation Protection Calibration Facility at Site 38  
Effective: August-2019 through January-2020

Serial# 17 Name DAN Date 10/30/19  
 Temperature AWS °F Humidity AWS % TPS# 0 DVM# 12 Detector# 17  
 Last Known Location Site 38 Receiving RAD COM Cabinet

1. **Source Wipe:** As per RPIT source wipe procedure, wipe and record source# 137(-2.2)-50

2. **Battery change:**  Open case and change 2 "D" size alkaline batteries.

Source to Detector Reference



3. **As Found Performance Check:**

Using the table below record the as-found response for each range and exposure rate. The final readings and adjustments for the detector calibration will be recorded later. All calibration adjustments are located inside of the instrument and are well labeled.

- a. In the LLCF, expose the detector to the following exposure rates. Record meter readings. Calculate net count by subtracting background from each reading. Ex. If background=40 CPM and the as-found 0.1 mR/Hr meter reading is 350 CPM then the net as-found reading is 310 CPM. (350-40=310) The net reading must be compared to the tolerance to determine if the instrument is in specification or out.

As Found/Detector Calibration								
Range	Source	Distance	Exposure Rate	CPM Meter Reading <small>Tolerances are DT Corrected</small>				Tolerance
				As-Found		Final		
X1	N/A	95.0	Background	NFG	Net	30	Net	N/A
X1	137-2.4-2	95.0	0.1 mR/Hr			340	310	268 - 402
X10	137-3.4-3	104.0	1.0 mR/Hr			3300	N/A	2660 - 4000
X100	137-4.5-1	97.9	10 mR/Hr			32K	N/A	28.2K - 34.5K

If any of the above As-Found readings are out of tolerance the PCN system must be invoked. The detector probe check tolerance was determined by the tube manufacture. They state the tube as 3350 CPM/mR/Hr ±20% using 137Cs.

4. **Overload Test:** Expose the instrument to a 30 mR/Hr field using the 137-4.5-1 at a distance of 56.8 cm. Meter must not drop below full scale.   
 Remove the instrument from the 30 mR/Hr field. Meter must return to background in <2 minutes.

5. **Physical Inspection:**  Move instrument to a technician bench and physically inspect the outside and inside of the E-140N for damage, loose or broken connections, etc. and repair any problems found.

6. **Clean Instrument:**  Clean the entire outside of the instrument using a mild cleaner and paper towels "KayDry". Remove all extraneous tape, calibration labels, etc., from the instrument.

7. **Electronic Checks:** Using the tables, record the information as required following the procedures in a - j.
- With the power switch in the off position, check the mechanical zero of the meter. The zero adjustment screw is located on the front of the meter. Adjust if needed. Record results.
  - Turn scale switch to the BATT position. Meter must be in the BATT OK region, which is equivalent to a meter reading of 320 - 500. Record results.
  - Using a DVM measure and record the battery voltage across BT1 and BT2. Voltage must be greater than 3 volts.
  - Using a DVM and high voltage probe measure and record the high voltage of the instrument.

		As-Found	Final	Adjust	Observe	Tolerance
a.	Mech. Zero	NFG	0	meter	meter	0
b.	BATT OK		420	N/A	meter	325 - 500
c.	Batt. Voltage		3.1	N/A	DVM	>3 volts
d.	High Voltage		906	N/A	DVM	880 - 920

\*when measuring the HV use a 1000 megohm high voltage probe and a DVM with an input impedance of 10<sup>7</sup> ohms.

- Remove cable from detector and connect it to the GM output of a TPS. Turn TPS power on and set to GM.
- Set frequency of TPS to 10 and divide by to 2. Set speaker switch to the ON position, response to fast and the range switch to the X1 position. Audible clicks must be heard.
- Set speaker switch to the OFF position. Audible clicks must not be heard.

- h. Push and hold the reset button on the TPS. Observe the rate at which the meter drops. Release reset push button. Change response to slow. Push and hold the reset button on the TPS. Observe the rate at which the meter drops. It must be slower than the fast position.  Release reset push button.
- i. Push and hold the reset button on the E-140N. The meter must drop to zero rapidly.
- j. Using the table below set TPS as needed. Record all as found readings, then adjust if necessary.

As Found/Pulser Calibration							
Range	Input Frequency (CPM)	TPS Setting		CPM Meter Reading		Adjust	Tolerance
		Freq.	Divide by	As-Found	Final		
X1	250	100	24	NFG	* 250	X1	225 - 275
X1	100	10	6	↓	100		90 - 110
X1	400	100	15		400		360 - 440
X10	2.5K	1K	24		* 2.5K	X10	2.25K - 2.75K
X10	1K	100	6		1050		0.9K - 1.1K
X10	4K	1K	15		4K		3.6K - 4.4K
X100	25K	10K	24		* 25K	X100	22.5K - 27.5K
X100	10K	1K	6		10K		9K - 11K
X100	40K	10K	15		40K		36K - 44K

The \* above indicates the calibration set point. This instrument is calibrated to true pulse repetition rates, and will read the true count rate from the detector.

8. **Calibration:** Reattach probe to instrument.
- a. Were all tolerances to this point for both radiation and electronic checks within the specifications stated? Select one.  Yes. Go to step 8.b.  No. Go to step 8.d.
  - b. Were any adjustments made? Select one.  Yes. Go to step 8.d.  No. Go to step 8.c.
  - c. To indicate no adjustments were made, write the word *same* under the final column in each table.  Go to step 9.
  - d. Using the form in step 3, complete the information needed under the column final. Make adjustments as needed.

9. **Check Source Measurement:**
- a. Set function switch to x1 and record background reading. 30 CPM (Background must be <100)
  - b. Place the detector in the instruments check source holder. Record the reading. 210 CPM
  - c. Subtract reading 9.a. from reading 9. b. and record. 180
  - d. Subtract 20% from the reading in 9.c. and record. 150 CPM (if needed, round up measurement for ease of reading)
  - e. Add 20% to the reading in 9.c. and record. 210 CPM (if needed, round down measurement for ease of reading)
  - f. Remove old CHECK SOURCE READS label and attach a new one to the side of the instrument. Record measurements in 9.d. and 9.e. on the label.

10. **DPM Calculation:** Using the DPM calculation computer program, determine the detector's gamma efficiency and DPM/CPM ratio using the final CPM reading from form 3.c line 3 (1.0mR/Hr line). Record information in the spaces provided. Attach a label to the detector containing the following information: Efficiency, DPM/CPM, technician's name, calibration date, instrument and serial number.
- gamma efficiency 4 % 252 DPM/CPM

11. **Calibration Label:** Place new calibration labels on the instrument. Record the information needed in the spaces provided. This instrument is due for calibration every year. Y

12. **Comments:** Attach any comments to this page.

Reviewed By:  Date: 11-12-19