



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

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Sweetwater, TX 79556, U.S.A. Knoxville, TN 37932, U.S.A.

CUSTOMER CABRERA SERVICES

ORDER NO. 20280903/429686

Mfg. Ludlum Measurements, Inc. Model 2224-1 Serial No. 227246
Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR244549
Cal. Date 22-Dec-15 Cal Due Date 22-Dec-16 Cal. Interval 1 Year Meterface 202-848

Check mark ☒ applies to applicable instr. and/or detector IAW mfg. spec. T. 74 °F RH 21 % Alt 704.0 mm Hg

- ☐ New Instrument Instrument Received ☒ Within Toler. $\pm 10\%$ ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments
- ☒ Mechanical ck. ☒ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☐ F/S Resp. ck. ☒ Reset ck. ☒ Window Operation ☒ Geotropism
☒ Audio ck. ☐ Alarm Setting ck. ☒ Batt. ck. (Min. Volt) 2.2 VDC
☒ Calibrated in accordance with LMI SOP 14.8 ☐ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 925 V Input Sens. Comments mV Det. Oper. 925 V at Comments mV Threshold = mV

☒ HV Readout (2 points) Ref./Inst. 500 / 497 V Ref./Inst. 1500 / 1510 V

COMMENTS:

Alpha Threshold: 120mv
Beta Threshold: 3.5mv
Beta Window: 30mv
Firmware: 390094
Overload set to simulate light leak.
TH-230 #121495 act. 19,800cpm ct. 3,561cpm Bg0 ¹⁸ 20% 4Pi
TC-99 #5279 act. 28,800dpm ct. 5,850cpm Bg149 20% 4Pi

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X1000	800kcpm	800	800
X1000	200kcpm	200	200
X100	80kcpm	800	800
X100	20kcpm	200	200
X10	8kcpm	800	800
X10	2kcpm	200	200
X1	800cpm	800	800
X1	200cpm	200	200

*Uncertainty within $\pm 10\%$ C.F. within $\pm 20\%$

ALL Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	800kcpm	800452	800452		
	80kcpm	80220	80220		
	8kcpm	8009	8009		
	800cpm	800	800		
	80cpm	80	80		

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques.
The calibration system conforms to the requirements of ANSI/NCCL Z540-1-1994 and ANSI N323-1978
State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: Cs-137 S/N: ☐ 059 ☐ 2171CP ☐ 2261CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1616 ☐ 1696 ☐ 1909 ☐ 1916CP ☐ 5105 ☐ 5717CO
☐ 5719CO ☐ 60646 ☐ 70897 ☐ 73410 ☐ E552 ☐ G112 ☐ M565 ☐ S-394 ☐ S-1054 ☐ T10081 ☐ T10082 Neutron Am-241 Be S/N: ☐ T-304 Ra-226 S/N: ☐ Y982

☐ Alpha S/N ☐ Beta S/N ☐ Other

☒ m 500 S/N 238275 ☐ Oscilloscope S/N ☒ Multimeter S/N 70602478

Calibrated By: Duane Jackson Date 22 Dec 15

Reviewed By: Paul H. Date 30 Dec 15

Bench Test Data For Detector

Detector 43-93 Serial No. PR 244549

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Customer CABRERA SERVICES

Alpha Input Sensitivity 120 mV

Counter 2224-1 Serial No. 227246

Beta Input Sensitivity 3.5 mV

Count Time 1Minute

Beta Window 30 mV

Other _____

Distance Source to Detector Sustank

Isotope Pu-239
Size 25.2 Kcpm

Isotope TC-99
Size 28.8 Kcpm

Isotope Sr 90
Size 90,6070p-n

[illegible]

☐ Gas Proportional detector count rate decreased $\leq 10\%$ after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased $\leq 10\%$ after 5 hour static test using 39" cable and alpha/beta counter.

Signature Dea. Dyabon

Date 22-Dec-15