



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.

10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

CUSTOMER **CABRERA SERVICES**

ORDER NO. **20220184/390463**

Mfg. Ludlum Measurements, Inc. Model 2221 Serial No. 176947

Mfg. Ludlum Measurements, Inc. Model 44-110 Serial No. PR 178079

Cal. Date 15-APR-13 Cal Due Date 15-APR-14 Cal. Interval 1 Year Meterface 202-159

Check mark applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 36 % Alt 702.8 mm Hg

New Instrument Instrument Received Within Toler. +-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) 4.4 VDC

Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 1650 V Input Sens. 4 mV Det. Oper. 1650 V at 4 mV Threshold Dial Ratio 100 = 4 mV

HV Readout (2 points) Ref./Inst. 500 / 502 V Ref./Inst. 2000 / 1992 V

COMMENTS:

H3 SN:LC 306, Size:1872dpm, Counts:994cpm, Background:284cpm, 4pi Eff:37.92%
H3 SN:LC 306, Size:936cpm, Counts:994cpm, Background:284cpm, 2pi Eff:75.85%
C14 SN:1476, Size:229767dpm, Counts:44509cpm, Background:284cpm, 4pi Eff:19.24%
C14 SN:1476, Size:114883cpm, Counts:44509cpm, Background:284cpm, 2pi Eff:38.49%
Cal'd with 5ft cable. Firmware:261027

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*
x1K	400kcpm	400	400
x1K	100kcpm	100	100
x100	40kcpm	400	400
x100	10kcpm	100	100
x10	4kcpm	400	400
x10	1kcpm	100	100
x1	400cpm	400	400
x1	100cpm	100	100

*Uncertainty within ± 10% C.F. within ± 20%

ALL Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	Log Scale	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
400kcpm	3998.6(0)	3998.6(0)		500kcpm	500 kcpm	500 kcpm
40kcpm	3998	3998		50kcpm	50	50
4kcpm	400	400		5kcpm	5	5
400cpm	40	40		500cpm	500 cpm	500 cpm
40cpm	4	4		50cpm	50	50

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: 059 280 720 734 781 1131 1616 1696 5105 5717CO 5719CO
 60646 70897 73410 E551 E552 G112 M565 S-394 S-1054 T-304 T879 T10081 T10082 Y982

Alpha S/N _____ Beta S/N Tc99SN:5280,H3SN:306 Other _____

m 500 S/N 190566 Oscilloscope S/N _____ Multimeter S/N 86250390

Calibrated By: Jam F Date 15-APR-13

Reviewed By: David H Date 16 APR 13

AC Inst. Passed Dielectric (HI-Pot) and Continuity Test
Only Failed: _____



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Bench Test Data For Detector

Detector 44-110 Serial No. PR 178079
Customer CABRERA SERVICES Order # 20220184/390463
Counter 2221 Serial No. 176947 Counter Input Sensitivity 4 mV
Count Time 1 min. Distance Source to Detector Surface
Other _____

High Voltage	Background	Isotope H ³ Size	Isotope Tc ⁹⁹ Size	Isotope Size	Isotope Size
1600	193	775	35766		
1625	236	940	37696		
1650	284	994	38982		
1675	365	1092	40169		
1700	396	1161	41498		

Signature *[Signature]* Date 15-APR-13