



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES ORDER NO. 20212984/385896

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 184938
Mfg. Ludlum Measurements, Inc. Model 43-37 Serial No. PR178371
Cal. Date 18-Dec-12 Cal Due Date 18-Dec-13 Cal. Interval 1 Year Meterface 202-855

Check mark applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 36 % Alt 700.8 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) 2.2 VDC
- RS-232 Port OK
- 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 1675 V

HV Readout (2 points) Ref./Inst. 500 / 502 V Ref./Inst. 2000 / 2008 V

Firmware Version: 39010v25 (EEPROM Settings)
Alpha Threshold: 100 mv User Time: 1.0
Beta Threshold: 4 mv Alpha Alarm: 999999
Beta Window: 40 mv Beta Alarm: 999999
Overload Checked But Not Set. A/B Alarm: 999999
Instrument calibrated with a 5ft. 395A cable. Model 2360 Date: 12/18/2012
High voltage set with detector NOT connected. Calibration Date Due: 12/18/2013

COMMENTS:

See attachment for efficiencies.

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	400k cpm	400	400
x1000	100k cpm	100	100
x100	40k cpm	400	400
x100	10k cpm	100	100
x10	4k cpm	400	400
x10	1k cpm	100	100
x1	400 cpm	400	400
x1	100 cpm	100	100

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

ALL Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400kcpm	39992 (0)			
	40kcpm	3999			
	4kcpm	400			
	400cpm	40			
	40cpm	4			

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. State of Texas Calibration License No. LO-1963
The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978

Reference Instruments and/or Sources: 73410 1131 781 059 280 60646 70897 Ra-226 S/N Y982
Cs-137 Gamma S/N 1162 G112 M565 5105 T1008 T879 E552 E551 720 734 1616 Neutron Am-241 Be S/N T-304

Alpha S/N Th230 SN:E121495 Beta S/N Tc99 SN:5280,SrY90 Other _____
 m 500 S/N 190566 Oscilloscope S/N _____ Multimeter S/N 86250390

Calibrated By: Jamie Date 18-Dec-12
Reviewed By: Shel Date 19-Dec-12

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



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Bench Test Data For Detector

Detector 43-37 Serial No. PA178371 Order # 20212984/385896
 Customer CABRERA SERVICES Alpha Input Sensitivity 100 mV
 Counter 2360 Serial No. 184938 Beta Input Sensitivity 4 mV
 Count Time 1Minute Beta Window 40 mV
 Other _____ Distance Source to Detector Surface

High Voltage	Background		Isotope <u>JH230</u> Size <u>19800 dpm</u>		Isotope <u>Tc99</u> Size <u>93200 dpm</u>		Isotope <u>Sr90</u> Size <u>98055</u> J.K. <u>98550 dpm</u>		Isotope <u>Ni63</u> Size <u>280409 dpm</u>	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
<u>1625</u>	<u>2</u>	<u>483</u>	<u>3486</u>	<u>1593</u>	<u>19</u>	<u>26613</u>	<u>1</u>	<u>23606</u>	<u>6</u>	<u>11517</u>
<u>1650</u>	<u>3</u>	<u>634</u>	<u>3552</u>	<u>1716</u>	<u>25</u>	<u>29001</u>	<u>6</u>	<u>27624</u>	<u>6</u>	<u>12412</u>
<u>1675</u>	<u>4</u>	<u>845</u>	<u>3673</u>	<u>1848</u>	<u>49</u>	<u>29064</u>	<u>27</u>	<u>30960</u>	<u>0</u>	<u>13456</u>
<u>1700</u>	<u>5</u>	<u>1017</u>	<u>3656</u>	<u>1985</u>	<u>176</u>	<u>27240</u>	<u>154</u>	<u>33787</u>	<u>1</u>	<u>13858</u>
<u>1725</u>	<u>8</u>	<u>1126</u>	<u>3934</u>	<u>1922</u>	<u>673</u>	<u>24731</u>	<u>473</u>	<u>33212</u>	<u>10</u>	<u>13099</u>

- Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.
- Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature *Jan Fu* Date 18-Dec-11

Attachment

Efficiencies taken with 2360 SN:184938 & 43-37 SN:PR178371

Th230 SN:E121495

Size: 10100cpm,
Background: 4cpm, Counts: 3673cpm
2pi Eff: 36.36%,

Tc99 SN:5280

Size: 58300cpm,
Background: 845cpm, Counts: 29064cpm
2pi Eff: 48.40%,

SrY90 SN:5281

Size: 68985cpm,
Background: 845cpm, Counts: 30960cpm
2pi Eff: 43.65%,

Ni63 SN:4017

Size: 138963cpm,
Background: 845cpm, Counts: 13456cpm
2pi Eff: 9.07%,

Attachment

Efficiencies taken with 2360 SN:184938 & 43-37 SN:PR178371

Th230 SN:E121495

Size: 19800dpm,
Background: 4cpm, Counts: 3673cpm
4pi Eff: 18.53%,

Tc99 SN:5280

Size: 93200dpm,
Background: 845cpm, Counts: 29064cpm
4pi Eff: 30.27%,

SrY90 SN:5281

Size: 98550dpm,
Background: 845cpm, Counts: 30960cpm
4pi Eff: 30.55%,

Ni63 SN:4017

Size: 277926dpm,
Background: 845cpm, Counts: 13456cpm
4pi Eff: 4.53%,