LUDLUM MODEL 5
GEIGER COUNTER

May 2014

Serial Number 236626 and Succeeding

Serial Numbers

LUDLUM MODEL 5
GEIGER COUNTER

May 2014

Serial Number 236626 and Succeeding

Serial Numbers

LUDLUM MEASUREMENTS, INC
501 OAK STREET, P.O. BOX 810
SWEETWATER, TEXAS 79556
325-235-5494, FAX: 325-235-4672

STATEMENT OF WARRANTY

Ludlum Measurements, Inc. warrants the products covered in this manual to be free of defects due to workmanship, material, and design for a period of twelve months from the date of delivery. The calibration of a product is warranted to be within its specified accuracy limits at the time of shipment. In the event of instrument failure, notify Ludlum Measurements to determine if repair, recalibration, or replacement is required.

This warranty excludes the replacement of photomultiplier tubes, G-M and proportional tubes, and scintillation crystals which are broken due to excessive physical abuse or used for purposes other than intended.

There are no warranties, express or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description of the face there of. If the product does not perform as warranted herein, purchaser's sole remedy shall be repair or replacement, at the option of Ludlum Measurements. In no event will Ludlum Measurements be liable for damages, lost revenue, lost wages, or any other incidental or consequential damages, arising from the purchase, use, or inability to use product.

RETURN OF GOODS TO MANUFACTURER

If equipment needs to be returned to Ludlum Measurements, Inc. for repair or calibration, please send to the address below. All shipments should include documentation containing return shipping address, customer name, telephone number, description of service requested, and all other necessary information. Your cooperation will expedite the return of your equipment.

LUDLUM MEASUREMENTS, INC.
ATTN: REPAIR DEPARTMENT
501 OAK STREET
SWEETWATER, TX 79556

800-622-0828 325-235-5494
FAX 325-235-4672

Table of Contents

Introduction *1*

Getting Started *2*

Unpacking and Repacking 2-1

Battery Installation 2-1

Battery Test 2-2

Instrument Test 2-2

Reading the Meter Face Dial 2-2

Operational Check 2-3

Specifications *3*

Identification of Controls and Functions *4*

Safety Considerations *5*

Environmental Conditions for Normal Use 5-1

Warning Markings and Symbols 5-1

Cleaning and Maintenance Precautions 5-2

Maintenance *6*

Recalibration 6-1

Batteries 6-1

Troubleshooting *7*

Troubleshooting Electronics which utilize GM Detectors 7-1

Troubleshooting GM Detectors 7-3

Recycling *8*

Parts List *9*

Model 5 Geiger Counter 9-1

Main Board, Drawing 464 × 272 9-1

HV Power Supply Board, Drawing 464 × 249 9-3

Drawings and Diagrams *10*

Section

1

Introduction

The Model 5 is a self-contained portable Geiger Counter with two internal Geiger-Mueller (GM) tubes and five linear ranges used in combination with exposure rate or CPM meter dials. The first three ranges use an LND 71210 (or equivalent), while the lower two ranges use an LND 71412 (or equivalent). Both have 1/32-inch cadmium shields to attenuate low-energy response.

The instrument features a regulated high-voltage power supply, overload circuitry, unimorph speaker with audio ON-OFF capability, fast-slow meter response, meter reset button, battery check button and a six-position switch for selecting range multiples of ×0.1, ×1, ×10, ×100 and ×1000. Each range multiplier has its own calibration potentiometer located under a protective cover on the front panel. The unit body and meter housing are made of cast aluminum and the can is 0.23 cm (0.090 in.) thick aluminum.

The unit is operated with two ″D″ cell batteries for operation from -20° to 50°C (-4° to 122° F). For instrument operation below 0°C (32°F), either very fresh alkaline or rechargeable NiCd batteries should be used.

Section

2

Getting Started

Unpacking and Repacking

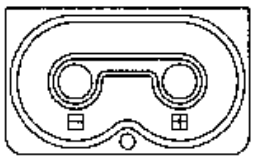
Remove the calibration certificate and place it in a secure location. Remove the instrument and accessories (batteries, cable, etc.) and ensure that all of the items listed on the packing list are in the carton. Check individual item serial numbers and ensure calibration certificates match. The Model 5 serial number is located on the front panel below the battery compartment.

To return an instrument for repair or calibration, provide sufficient packing material to prevent damage during shipment.

Every returned instrument must be accompanied by an Instrument Return Form, which can be downloaded from the Ludlum website at www.ludlums.com. Find the form by clicking the "Support" tab and selecting "Repair and Calibration" from the drop-down menu. Then choose the appropriate Repair and Calibration division where you will find a link to the form.

Battery Installation

Ensure the Model 5 range selector switch is in the OFF position. Open the battery lid by pushing down and turning the quarter-turn thumbscrew counterclockwise a quarter of a turn. Install two ″D″ size batteries in the compartment.



Note the (+) and (-) marks inside the battery door. Match the battery polarity to these marks. Close the battery box lid, and then push down and turn the quarter-turn thumb screw clockwise a quarter of a turn.

Note:

The center post of a "D" size battery is positive.

Battery Test

Check the batteries daily or prior to use, whichever is less frequent, to assure proper operation of the instrument. Move the range multiplier switch to the ×1000 position and press the BAT button. Ensure that the meter needle deflects to the battery check portion on the meter scale. If the meter does not respond, check to see if the batteries have been correctly installed. Replace the batteries if necessary.

Instrument Test

After checking the batteries, place the AUD ON-OFF switch in the ON position. Expose the internal detectors to a check source. The instrument speaker should emit ″clicks″ relative to the rate of counts detected. The AUD ON/OFF switch will silence the audible clicks if in the OFF position. It is recommended that the AUD ON/OFF switch be kept in the OFF position when not needed in order to preserve battery life.

Warning:

A low-battery condition results in a steady audio tone regardless of the position of the AUD ON/OFF switch.

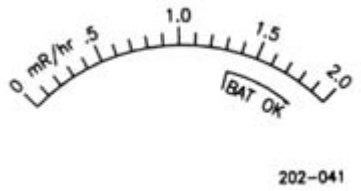
Check the meter reset function by depressing the RES pushbutton switch and ensuring the meter needle drops to ″0″.

Once this procedure has been completed, the instrument is ready for use.

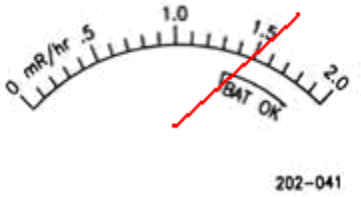
Reading the Meter Face Dial

Reading the meter face is very important for consistent measurements. The Model 5 typically has an exposure rate 0-2.0 mR/hr meter face. The following examples are intended to help the user interpret the correct reading.

The normal procedure is to turn the range selector switch to the highest range, and if no readings are seen on the meter, turn the selector switch down to the lower scales until a reading is seen. The ranges on the instrument selector switch are multipliers for the meter reading. A typical single scale (one arc) meter face with mR/hr dial is shown on the following page.



The count rate scale reads 0-2.0mR/hr and has BAT OK on the dial.



If the needle is pointing as indicated above and the instrument range selection switch is on the ×0.1 scale multiple, then the reading is 1.5 mR/hr (multiplied by) ×0.1 = .00015 R/hr.

The same needle indications on successive ranges would be:

×1 = 1.5 mR/hr (or .0015 R/hr)

×10 = 15 mR/hr (or .0.15 R/hr)

×100 = 150 mR/hr (or .15 R/hr)

×1000 = 1500 mR/hr (or 1.5 R/hr)

Operational Check

To assure proper operation of the instrument and the detector(s) between calibrations, an instrument operational check including battery test and instrument should be performed at least daily or prior to use, whichever is less frequent. A reference reading (or readings) with a check source should be obtained with the detector(s) in a constant and reproducible manner at the time of calibration or at the time the instrument is received in the field.

If at any time the instrument fails to read within 20% of the reference reading when using the same check source, it should be sent to a calibration facility for recalibration and/or repair. If desired, multiple readings may be taken at different distances and/or with different sources so that other ranges or scales are checked.

Section

3

Specifications

Indicated Use: gamma survey

Detectors: two internal, energy-compensated GM tubes

Multipliers: ×0.1, ×1, ×10, ×100 and ×1000 selected by a front-panel range selector switch

High Voltage: fixed at 540 ± 25 Vdc.

Input Sensitivity: 100 ± 30 mV for the low range detector; 425 ± 75 mV for the high range detector

Energy Response: within 15% of true value from 60 keV - 3 MeV

Saturation: in excess of 1000 R/hr

Meter: 6.4 cm (2.5 inch) arc, 1 mA, pivot-and-jewel suspension

Meter Dial: 0-2 mR/hr, BAT TEST (others available)

Range: typically 0-2000 mR/hr

Linearity: reading within 10% of true value

Calibration Controls: individual potentiometers for each range; accessible from the front cover while in operational status

Audio: built-in unimorph speaker with ON-OFF switch (greater than 60 dB at 2 feet)

Response: toggle switch for FAST (4 seconds) or SLOW (22 seconds) from 10% to 90% of final reading

Reset: pushbutton to ″zero″ the meter.

Overload: holds the meter needle at full-scale in high radiation fields.

Power: two ″D″ cell batteries housed in a sealed externally accessible compartment

Battery Life: typically greater than 2000 hours (battery condition may be checked on the meter face)

Battery Dependence: instrument calibration change less than 3% within battery check limits on the meter

Temperature Range: -20 to 50 °C (-4 to 122 °F)

Size: 24.1 x 8.9 x 21.6 cm (9.5 x 3.5 x 8.5 inch) (H x W x L), including instrument handle

Weight: 2 kg (4.4 lb) including batteries and detectors

Construction: cast and drawn aluminum with beige powder-coating.

Section

4

Identification of Controls and Functions

Meter: 6.4cm (2.5 inch) arc, 1 mA analog type with pivot-and-jewel suspension. Typical meter dial is 0-2 mR/hr and BAT TEST.

Range Selector Switch: A six-position switch marked OFF, ×1000, ×100, ×10, ×1, ×0.1. Turning the range selector switch to one of the range multiplier positions (×1000, ×100, ×10, ×1, or ×0.1) provides the operator with an overall range of 0 to 2000 mR/hr. Multiply the scale reading by the multiplier to determine the actual scale reading.

Range Calibration Adjustment: Recessed potentiometers located under the calibration cover, on the right side of the front panel. These adjustment controls allow individual calibration for each range multiplier.

Battery Compartment: Sealed compartment to house two ″D″ cell batteries.

RES Pushbutton: When depressed, this switch provides a rapid means of driving the meter needle to zero.

AUD ON-OFF Toggle Switch: In the ON position, operates the unimorph speaker, located on the left side of the instrument. The frequency of the clicks is relative to the rate of the incoming pulses. The higher the rate, the higher the audio frequency. The audio should be turned OFF when not required to reduce battery drain.

Warning:

A low-battery condition results in a steady audio tone, regardless of the position of the AUD ON/OFF switch.

F-S Toggle Switch: Provides meter response. Selecting the fast, ″F″ position, of the toggle switch provides 90% of full-scale meter deflection in four seconds. In the slow, ″S″ position, 90% of full-scale meter deflection takes 22 seconds. In the ″F″ position, there is fast response and large meter deviation. The ″S″ position should be used for slow response and damped meter deviation.

Over range adjustment (Internal HV Board, R3): This potentiometer is utilized in the calibration of the instrument only.

Section

5

Safety Considerations

Environmental Conditions for Normal Use

Indoor or outdoor use

No maximum altitude

Temperature range of -20 to 50 °C (-4 to 122 °F); may be certified for operation from -40 to 65 °C (-40 to 150 °F)

Maximum relative humidity of less then 95% (non-condensing)

Pollution Degree 1 (as defined by IEC 664)

Warning Markings and Symbols

Caution!

The operator or responsible body is cautioned that the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by Ludlum Measurements, Inc.

The Model 5 Geiger Counter is marked with the following symbols:

CAUTION (per ISO 3864, No. B.3.1) – designates hazardous live voltage and risk of electric shock. During normal use, internal components are hazardous live. This instrument must be isolated or disconnected from the hazardous live voltage before accessing the internal components. This symbol appears on the front panel. **Note the precautions on the following page:**

Warning!

The operator is strongly cautioned to take the following precautions to avoid contact with internal hazardous live parts that are accessible using a tool:

1. Turn the instrument power OFF and remove the batteries.
2. Allow the instrument to sit for 1 minute before accessing internal components.

The "**crossed-out wheelie bin**" symbol notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding; each material must be separated. The symbol is placed on the battery compartment lid. See section 8, "Recycling," for further information.

CE

The "CE" mark is used to identify this instrument as being acceptable for use within the European Union.

Cleaning and Maintenance Precautions

The Model 5 may be cleaned externally with a damp cloth, using only water as the wetting agent. Do not immerse the instrument in any liquid. Observe the following precautions when cleaning or performing maintenance on the instrument:

1. Turn the instrument OFF and remove the batteries.
2. Allow the instrument to sit for 1 minute before cleaning the exterior or accessing any internal components for maintenance.

Section

6

Maintenance

Instrument maintenance consists of keeping the instrument clean and periodically checking the batteries and the calibration. The Model 5 instrument may be cleaned with a damp cloth (using only water as the wetting agent). Do not immerse instrument in any liquid. Observe the following precautions when cleaning:

1. Turn the instrument OFF and remove the batteries.

2. Allow the instrument to sit for 1 minute before accessing internal components.

Recalibration

Recalibration should be accomplished after maintenance or adjustments have been performed on the instrument. Recalibration is not normally required following instrument cleaning or battery replacement.

Note:

Ludlum Measurements, Inc. recommends recalibration at intervals no greater than one year. Check the appropriate regulations to determine required recalibration intervals.

Ludlum Measurements offers a full-service repair and calibration department. We not only repair and calibrate our own instruments but most other manufacturer's instruments. Detailed calibration procedures are available upon request for customers who choose to calibrate their own instruments.

Batteries

The batteries should be removed any time the instrument is placed into storage. Battery leakage may cause corrosion on the battery contacts, which

must be scraped off and/or washed using a paste solution made from baking soda and water. Use a spanner wrench to unscrew the battery contact insulators, exposing the internal contacts and battery springs. Removal of the handle will facilitate access to these contacts.

Note:

Never store the instrument over 30 days without removing the batteries. Although this instrument will operate at very high ambient temperatures, battery seal failure may occur at temperatures as low as 38°C (100°F).

Section

7

Troubleshooting

Occasionally, you may encounter problems with your LMI instrument or detector that may be repaired or resolved in the field, saving turn-around time and expense in returning the instrument to us for repair. Toward that end, LMI electronics technicians offer the following tips for troubleshooting the most common problems. Where several steps are given, perform them in order until the problem is corrected. Keep in mind that with this instrument, the most common problems encountered are: (1) sticky meters, (2) battery contacts.

Note that the first troubleshooting tip is for determining whether the problem is with the electronics or with the detector. A Ludlum Model 500 Pulser is invaluable at this point, because of its ability to simultaneously check high voltage, input sensitivity or threshold, and the electronics for proper counting.

We hope these tips will prove to be helpful. As always, please call if you encounter difficulty in resolving a problem or if you have any questions.

Troubleshooting Electronics which utilize GM Detectors

SYMPTOM	**POSSIBLE SOLUTION**
No power (or meter does not reach BAT TEST or BAT OK mark)	1. Check batteries and replace if weak. 2. Check polarity (See marks inside batter lid). Are the batteries installed backwards? 3. Check battery contacts. Clean them with rough sandpaper or use an engraver to clean the tips.

SYMPTOM	POSSIBLE SOLUTION
Nonlinear Readings	1. Check the high voltage (HV) using a Ludlum Model 500 Pulser (or equivalent). If a multimeter is used to check the HV, ensure that one with high impedance is used, as a standard multimeter could be damaged in this process.
	2. Check for "sticky" meter movement. Does the reading change when you tap the meter? Does the meter needle "stick" at any spot?
	3. Check the "meter zero." Turn the power OFF. The meter should come to rest on "0".
Meter goes full scale or "Pegs Out"	1. Check the HV and, if possible, the input threshold for proper setting.
	2. Ensure that the instrument's ″can″ is properly attached. When attached properly, the speaker will be located on the left side of the instrument. If the can is on backwards, interference between the speaker and the input preamplifier may cause noise.
No Response to Radiation	1. Substitute a "known good" detector.
	2. Has the correct operating voltage been set? Refer to the calibration certificate or detector instruction manual for correct operating voltage. If the instrument uses multiple detectors, confirm that the high voltage is matched to the current detector being used.
No Audio	1. Ensure that the AUD ON-OFF switch is in the ON position.

SYMPTOM	POSSIBLE SOLUTION
No Audio (Continued)	2. Remove the instrument housing and check the connection between the circuit board and the speaker. Plug in the 2-pin connector if necessary.

Troubleshooting GM Detectors

1. If the tube has a thin mica window, check for window breakage. If damage is evident, the tube must be replaced.

2. Check the HV. For most GM tubes, the voltage is normally 900 Vdc, or 460-550 Vdc for "peanut" tubes (Ludlum Model 133 series).

3. Wires to the tube may be broken or the crimped connector could have a loose wire.

Section

8

Recycling

Ludlum Measurements, Inc. supports the recycling of the electronics products it produces for the purpose of protecting the environment and to comply with all regional, national and international agencies that promote economically and environmentally sustainable recycling systems. To this end, Ludlum Measurements, Inc. strives to supply the consumer of its goods with information regarding reuse and recycling of the many different types of materials used in its products. With many different agencies - public and private - involved in this pursuit, it becomes evident that a myriad of methods can be used in the process of recycling. Therefore, Ludlum Measurements, Inc. does not suggest one particular method over another, but simply desires to inform its consumers of the range of recyclable materials present in its products, so that the user will have flexibility in following all local and federal laws.

The following types of recyclable materials are present in Ludlum Measurements, Inc. electronics products, and should be recycled separately. The list is not all-inclusive, nor does it suggest that all materials are present in each piece of equipment:

Batteries	Glass	Aluminum and Stainless Steel
Circuit Boards	Plastics	Liquid Crystal Display (LCD)

Ludlum Measurements, Inc. products, which have been placed on the market after August 13, 2005 have been labeled with a symbol recognized internationally as the "crossed-out wheelie bin." This notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding; each material must be separated. The symbol will be placed near the AC receptacle, except for portable equipment where it will be placed on the battery lid.

The symbol appears as such: 

Section 9

Parts List

	Reference	Description	Part Number
Model 5 Geiger Counter	UNIT	Completely Assembled Model 5 Geiger Counter	48-1607
Main Board, Drawing 464 × 272	BOARD	Main Circuit Board	5464-272
CAPACITORS	C1	470pF, 100V	04-5668
	C2	0.1µF, 35V-T	04-5755
	C3	0.0047µF, 100V	04-5669
	C4-C5	470pF, 100V	04-5668
	C6	10uF, 10V-DT	04-5766
	C7	0.022µF, 50V	04-5667
	C9	10µF, 10V-DT	04-5766
	C10	100pF, 100V	04-5661
	C11-C13	68µF, 10V	04-5654
	C14	470pF, 100V	04-5668
	C15	100pF, 100V	04-5661
	C16	10µF, 10V-DT	04-5766
	C17	47µF, 10V	04-5666
	C18-C19	470pF, 100V	04-5668
	C30	10µF, 10V-DT	04-5766
	C31	1µF, 16V	04-5701
TRANSISTORS	Q1	MMBT3904LT1	05-5841
	Q2	MMBT4403LT1	05-5842
	Q3-Q6	2N7002L	05-5840
	Q7	MMBT3904LT1	05-5841
VOLTAGE REGULATOR	VR2	TPS76038	05-5912
INTEGRATED CIRCUITS	U1-U3	MAX4542EKA-T	06-6638
	U4	MAX986EUK-T	06-6601

	Reference	Description	Part Number
	U5	CMXT3904	05-5888
	U6	MAX986EUK-T	06-6601
	U7	MAX4541EKA-T	06-6637
	U9	CD74HC4538M	06-6297
	U10	LMC7111BIM5X	06-6410
	U11	LT1304CS8-5	06-6434
	U12	MIC1557BM5	06-6457
	U13	MAX985EUK-T	06-6459
	U14	ICL7660SCBA	06-6437
	U15	MAX4542EKA-T	06-6638
	U16	SN74AHHC1G00GW	06-6644
DIODES	CR1	CMPD2005S	07-6468
	CR2	CMSH1-40M	07-6411
	CR3-CR4	CMPD2005S	07-6468
SWITCHES	SW1	CENTRAL-2P6P	08-6761
	SW2	TP11LTCQE	7464-186
	SW3-SW4	7101SDCQE	08-6781
	SW5	TP11LTCQE	7464-186
POTENTIOMETERS / TRIMMERS	R12	50K, 60W503, ×1K	09-6838
	R33	1M, 64W105, ×100	09-6814
	R34	1M, 64W105, ×10	09-6814
	R35	1M, 64W105, ×1	09-6814
	R36	500K, 64W504, ×0.1	09-6850
RESISTORS	R1-R5	200K, 1/4W, 1%	12-7992
	R6-R7	10K, 1/4W, 1%	12-7839
	R8	2K, 1/4W, 1%	12-7926
	R9-R11	10K, 1/4W, 1%	12-7839
	R13-R17	10K, 1/4W, 1%	12-7839
	R18	100K, 1/4W, 1%	12-7834
	R19	2K, 1/4W, 1%	12-7926
	R20	100K, 1/4W, 1%	12-7834
	R21	10K, 1/4W, 1%	12-7839
	R22	1M, 1/4W, 1%	12-7844
	R23	200K, 1/4W, 1%	12-7992
	R24	14.7K, 1/4W, 1%	12-7068
	R25	200K, 1/4W, 1%	12-7992
	R26	100K, 1/4W, 1%	12-7834

	Reference	Description	Part Number
	R27	68.1K, 1/4W, 1%	12-7881
	R28	100K, 1/4W, 1%	12-7834
	R29	1K, 1/4W, 1%	12-7832
	R30	1M, 1/4W, 1%	12-7844
	R31	475K, 1/4W, 1%	12-7859
	R32	100K, 1/4W, 1%	12-7834
	R37	100K, 1/4W, 1%	12-7834
	R38	90.9K, 1/4W, 1%	12-7224
	R39-R42	100K, 1/4W, 1%	12-7834
	R43	4.75K, 1/4W, 1%	12-7858
	R44	2K, 1/4W, 1%	12-7926
	R45	200K, 1/4W, 1%	12-7992
	R46	14.7K, 1/4W, 1%	12-7222
	R47	1M, 1/4W, 1%	12-7844
	R48	100K, 1/4W, 1%	12-7834
	R49	10K, 1/4W, 1%	12-7839
	R50-R51	1M, 1/4W, 1%	12-7844
CONNECTORS	P1	640456-4 - MTA100x4	13-8088
	P2	640456-6 - MTA100x6	13-8095 (OPTIONAL)
	P3	640456-2 - MTA100x2	13-8073
	P4	640456-5 - MTA100x5	13-8057
INDUCTORS	L1	22 μH	21-9808
HV Power Supply Board, Drawing 464 × 249	BOARD	Completely Assembled HV Power Supply Board	5464-249
DETECTORS	V1	LND 71412	01-5306
	V2	LND 71210	01-5295
CAPACITORS	C1	10μF, 25V	04-5655
	C2	100PF, 3KV	04-5735
	C3	0.01μF, 3KV, 2%	04-5762
	C6	100PF, 3KV	04-5735
	C7-C12	0.01μF, 500V	04-5696
	C13	68μF, 10V	04-5654
	C14	0.1μF, 50V	04-5663
INTEGRATED CIRCUITS	U1	LT1304CS8	06-6394

	Reference	Description	Part Number
DIODES	CR1-CR3	CMSD2004S	07-6417
	CR7	CMSH1-40M	07-6411
POTENTIOMETER	R3	25K, 8026EKX-253, OJ ADJ.	09-6832
	R8	NOT USED	N/A
RESISTORS	R1-R2	1M, 1/4W, 1%	12-7844
	R4	1M, 1/4W, 1%	12-7844
	R5	4.75K, 1/4W, 1%	12-7858
	R6	500M, 3KV, 2%	12-7031
	R7	4.75K, 1/4W, 1%	12-7858
	R9	2.2M, 1/8W, 5%	12-7002
	R10	10M, 1/4W, 5%	12-7955
	R11	10K, 1/4W, 1%	12-7839
	R12	150K, 1/4W, 1%	12-7833
CONNECTOR	P6	640456-5 MTA100×5	13-8057
TRANSFORMER	T1	31032R	21-9925

Section

10

Drawings

MAIN CIRCUIT BOARD, Drawing 464 × 272 (3 sheets)

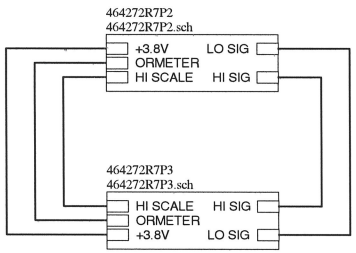
MAIN CIRCUIT BOARD LAYOUT, Drawing 464 × 273 (2 sheets)

HV POWER SUPPLY BOARD, Drawing 464 × 249

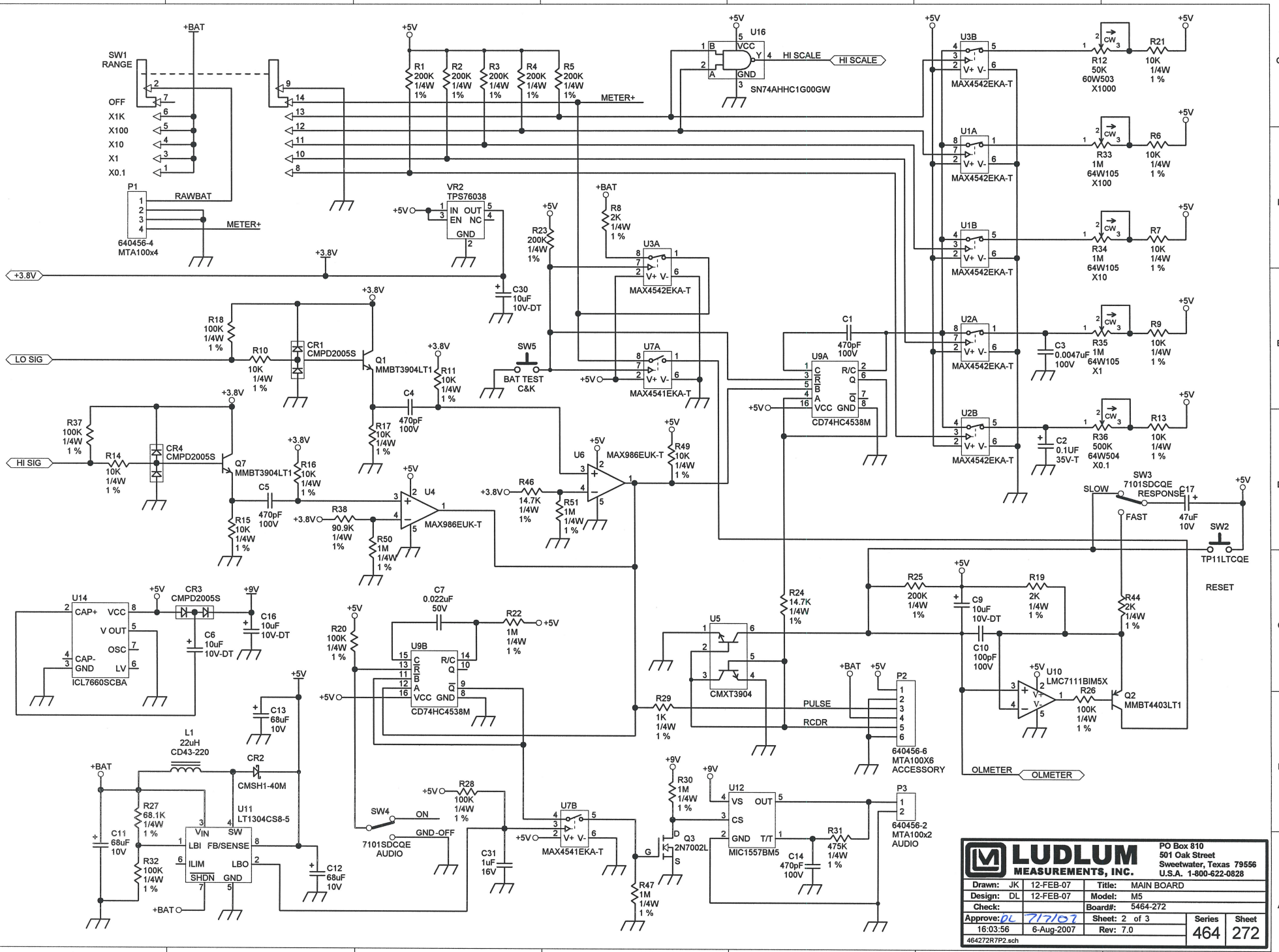
HV POWER SUPPLY BOARD LAYOUT, Drawing 464 × 250 (2 sheets)

WIRING DIAGRAM, Drawing 464 × 351

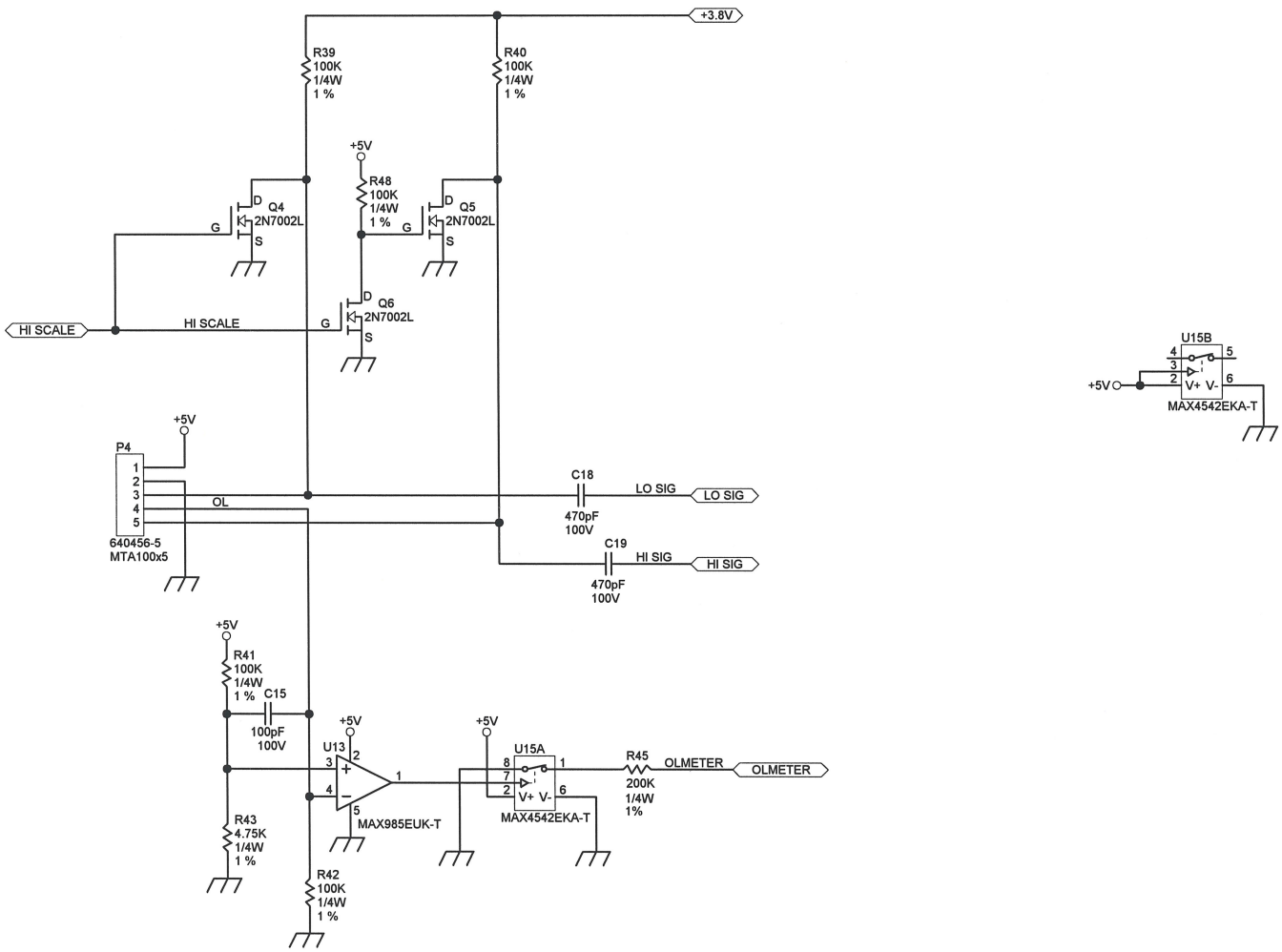
ENERGY RESPONSE for LMI Model 5



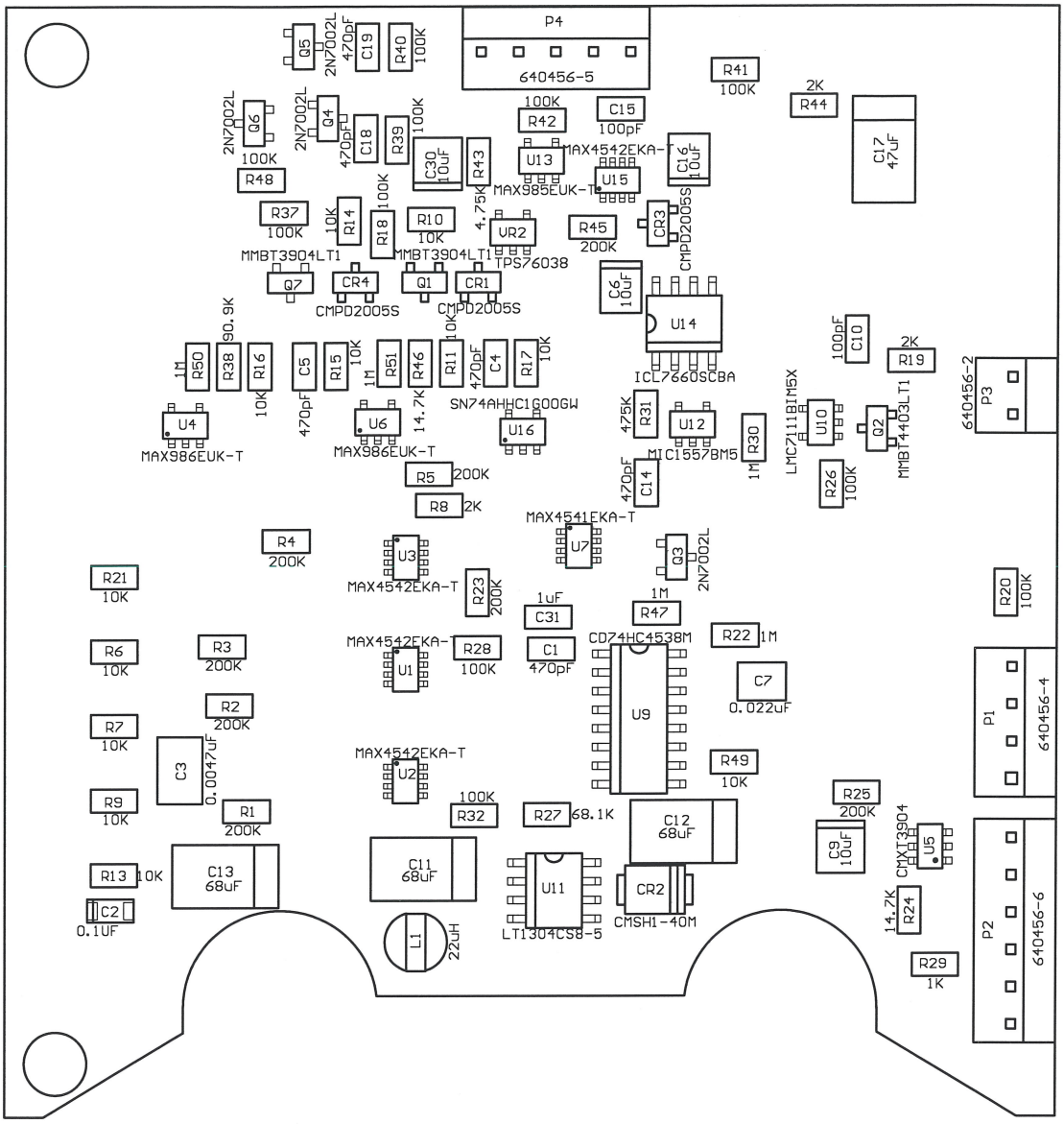
LUDLUM MEASUREMENTS, INC.			PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828
Drawn: JK	12-FEB-07	Title: MAIN BOARD	
Design: DL	12-FEB-07	Model: M5	
Check:		Board#: 5464-272	
Approve:	6-5-07	Sheet: 1 of 3	Series 464 / Sheet 272
14:33:58	5-Jun-2007	Rev: 7.0	
464272R7P1.sch			



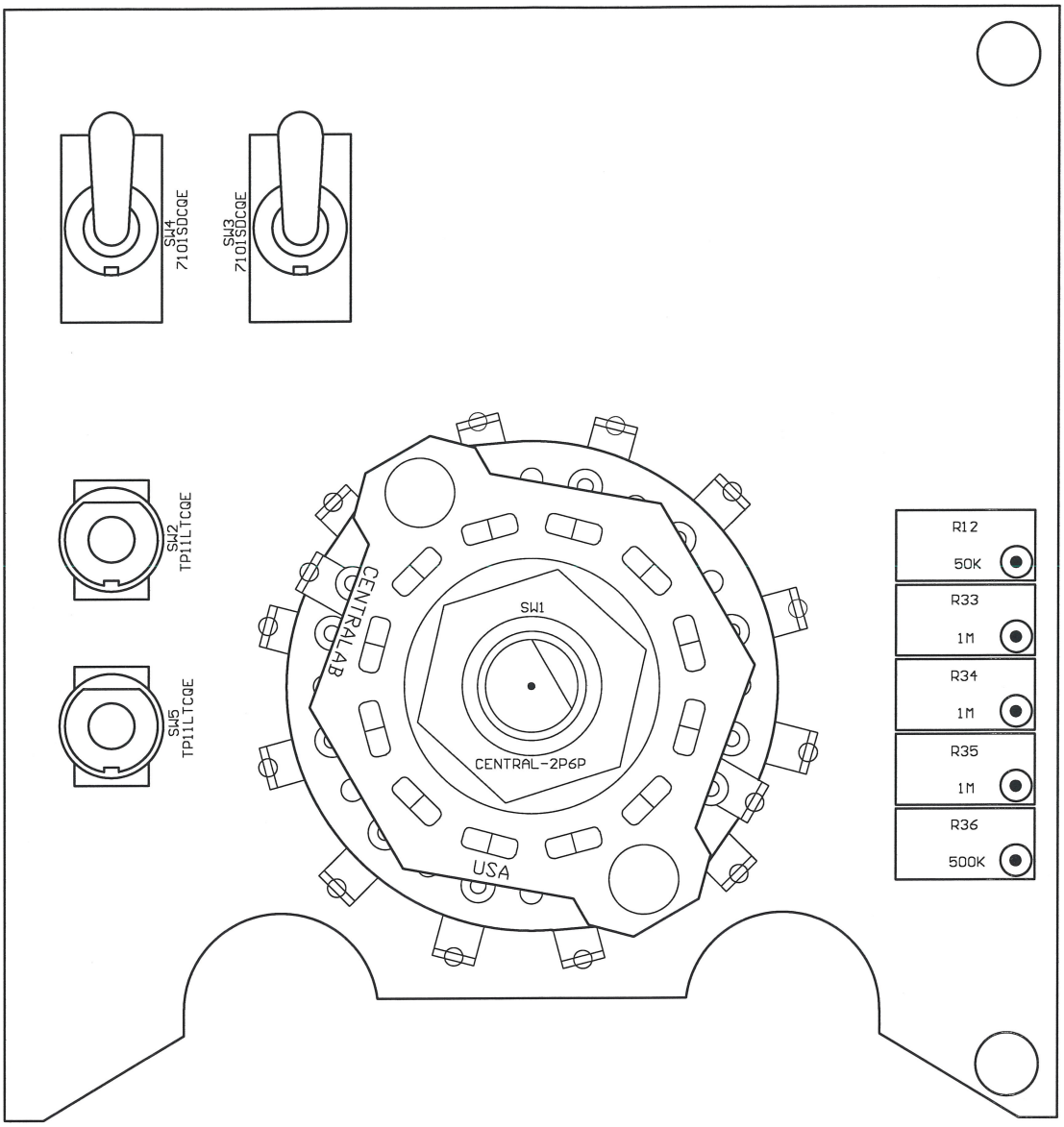
LUDLUM MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
Drawn: JK	12-FEB-07	Title: MAIN BOARD	
Design: DL	12-FEB-07	Model: M5	
Check:		Board#: 5464-272	
Approve: DL	7/7/07	Sheet: 2 of 3	Series 464 / Sheet 272
16:03:56	6-Aug-2007	Rev: 7.0	
464272R7P2.sch			



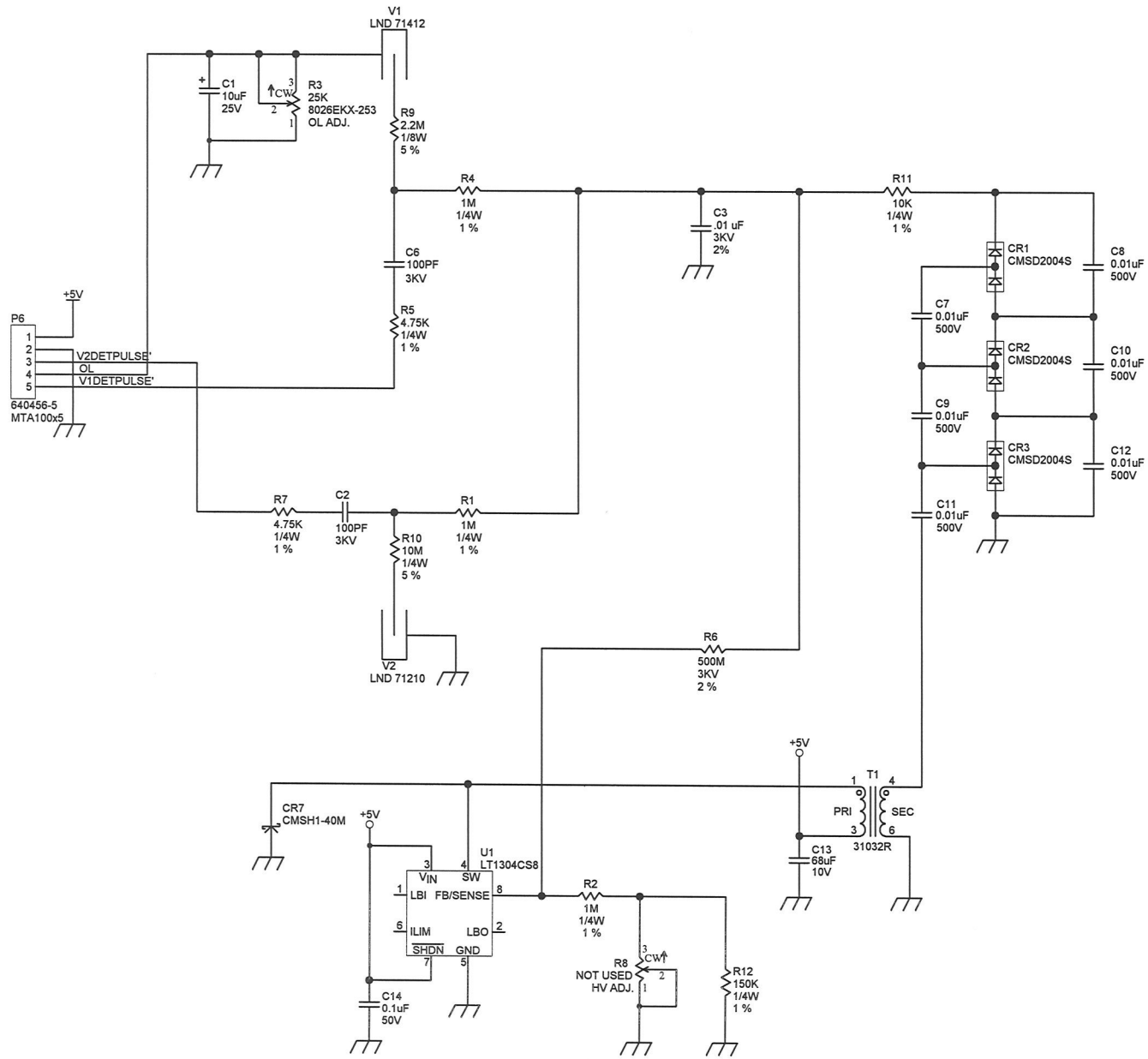
LUDLUM MEASUREMENTS, INC.	PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828		
Drawn: JK 12-FEB-07	Title: MAIN BOARD		
Design: DL 12-FEB-07	Model: M5		
Check:	Board#: 5464-272		
Approve: R 7/7/07	Sheet: 3 of 3	Series 464	Sheet 272
09:30:09 7-Aug-2007	Rev: 7.0		
464272R7P3.sch			



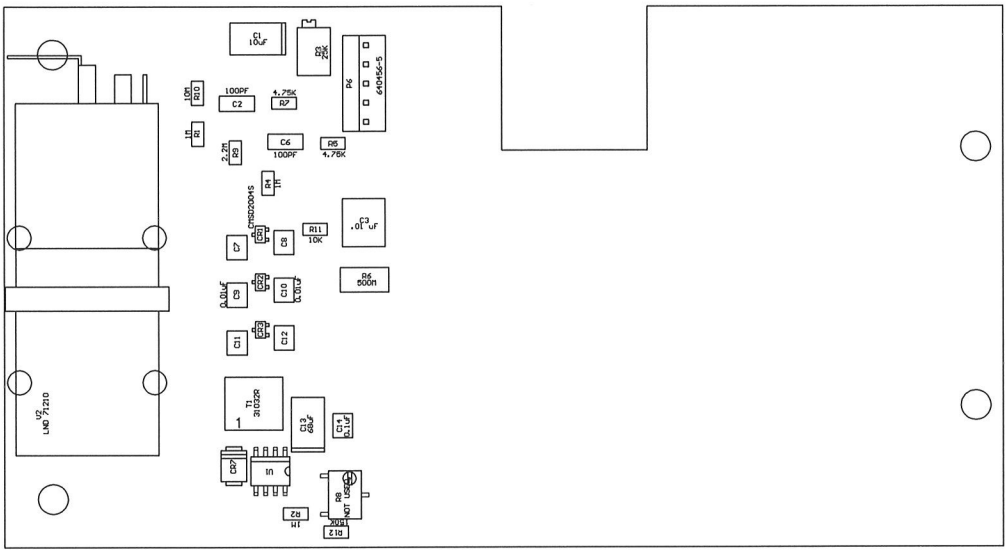
Drawn: JK	23-JAN-07	**Title:** MAIN BOARD			
Design: DL	23-JAN-07				
Check:		**Model:** M5			
Approve: DC	06-05-07	**Board#:** 5464-272			
Layer:		**Rev:** 7.0	**Series** 464	**Sheet** 273	
	14:32:33 5-Jun-2007	**SCALE:** 2.02			



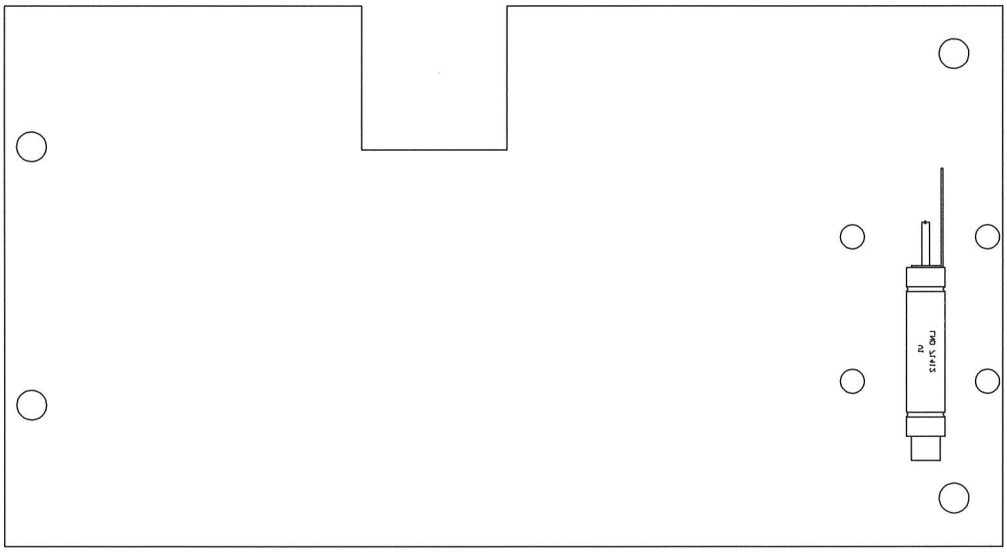
Drawn: JK	12-FEB-07	Title: MAIN BOARD			
Design: DL	12-FEB-07				
Check:		Model: M5			
Approve: DL	06-05-07	Board#: 5464-272			
Layer:		Rev: 7.0	Series 464	Sheet 273	
	14:32:33 5-Jun-2007	SCALE: 2.02			



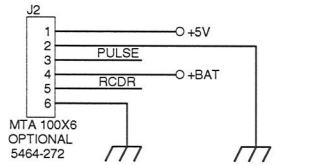
LUDLUM MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
Drawn: JK	11-OCT-06	Title: HV POWER SUPPLY BOARD	
Design: DL	11-OCT-06	Model: M5	
		Board#: 5464-249	
Approve:		Sheet: 1 of 1	Series 464 / Sheet 249
09:30:34	7-Aug-2007	Rev: 4.0	
464249R4.SCH			

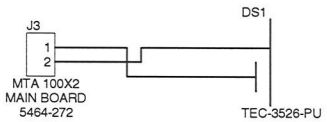


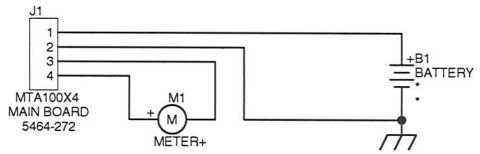
Drawn:	JK	11–OCT–06	Title: HV POWER SUPPLY		
Design:	DL	11–OCT–06			
Check:			Model: M5		
Approve:	DL	10-13-06	Board#: 5464–249		
			Rev: 4.0	Series 464	Sheet 250
			SCALE: 1.00		

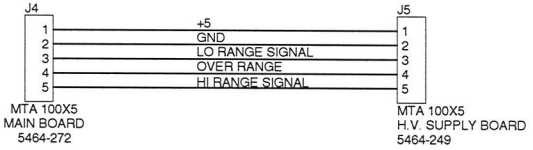


Drawn:	JK	11-OCT-06	Title: HV POWER SUPPLY		
Design:	DL	11-OCT-06			
Check:			Model: M5		
Approve:	DL	10-13-06	Board#: 5464-249		
			Rev: 4.0	Series 464	Sheet 250
			SCALE: 1.00		



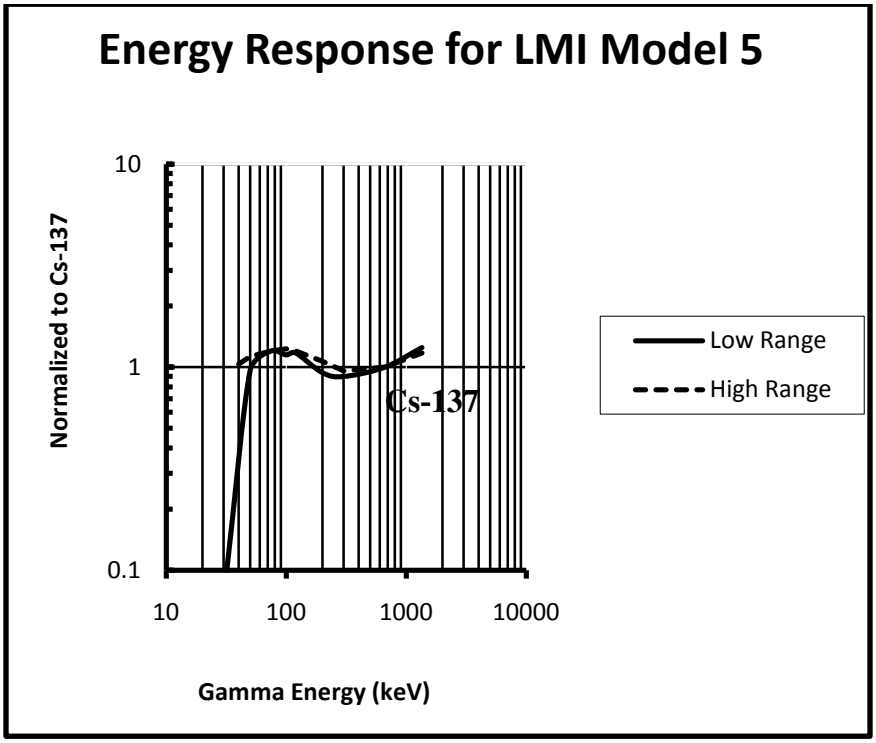






LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-622-0828

Drawn: SA	11/01/06	Title: WIRING DIAGRAM		
Design: RSS	11/01/06	Model: 5		
		Board#: 464-351		
Approve: DL	11/3/06	Sheet: 1 of 1	Series	Sheet
11:12:49	1-Nov-2006	Rev: 1.0	464	351
464351R1P1.SCH				


Energy Response for LMI Model 5
Normalized to Cs-137
10
1
0.1
10
100
1000
10000
Cs-137
Low Range
High Range
Gamma Energy (keV)