LUDLUM MODEL 3-97

SURVEY METER

June 2020
Serial No. 346285 and Succeeding
Serial Numbers

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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.

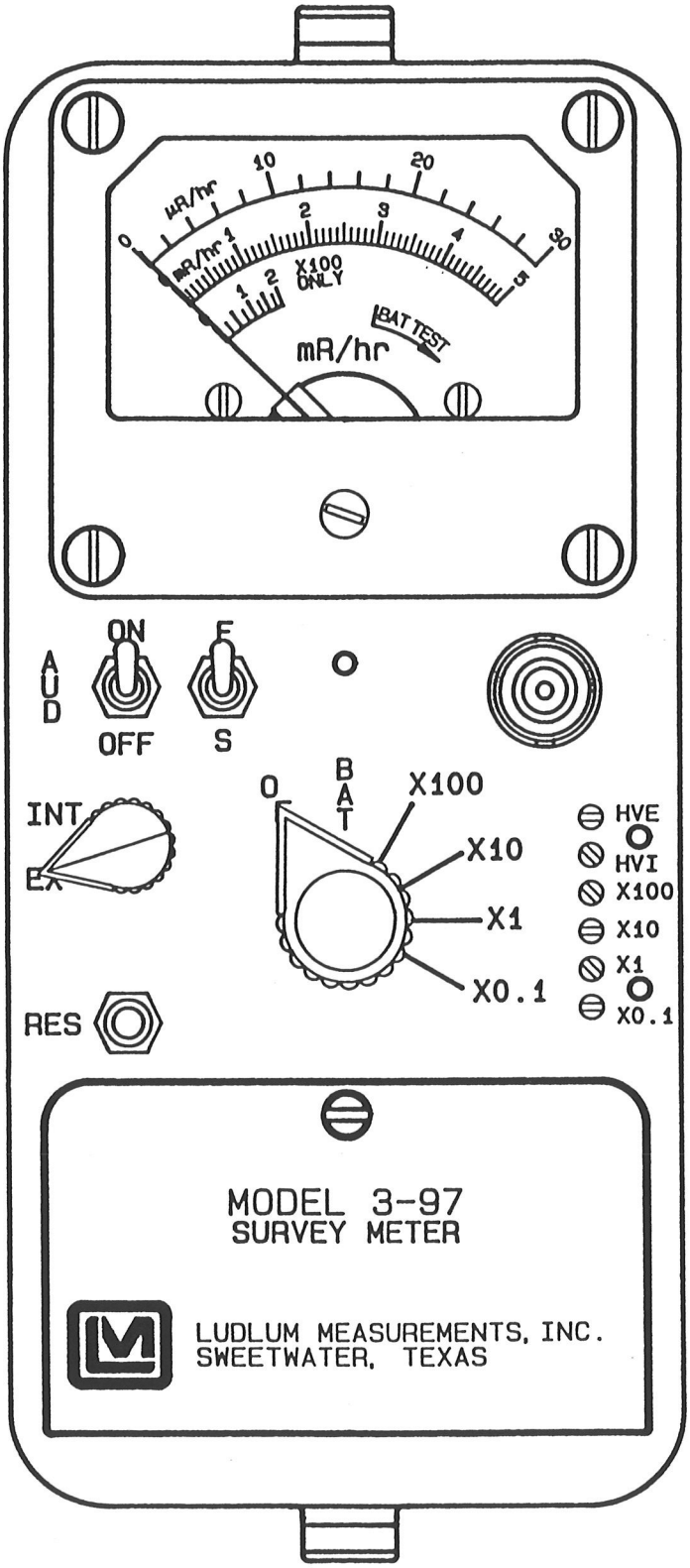
There are no warranties, express or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description of the face there of. If the product does not perform as warranted herein, purchaser's sole remedy shall be repair or replacement, at the option 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



DWG	NO.						DWN	CHK	APP
DWN	DATE	CHK	DATE		APP	DATE			
JGH	9-15-92		09APR01			4-09-01			
TOL: SHOP STD ☐ OTHER				SCALE: FULL ☐ OTHER					
TITLE M 3-97 SURVEY METER									
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556				SERIES 363			SHEET 592		

TABLE OF CONTENTS

Model 3-97 Survey Meter
June 2020

1. GENERAL

The Model 3-97 is a portable survey instrument with four linear ranges. Typical range values are 0-3000 μR/hr for the internal detector and 0-200 mR/hr for the external detector. The instrument features an internal scintillator that detects low-level gamma radiation, and also features the capability of utilizing an external probe by a switch on the front panel labeled INT/EXT. Separate high-voltage adjustments for the internal and external probes are provided. The high-voltage power supply is regulated and adjustable from 200 to 1200 V. The unit body is made of cast aluminum, including the meter housing. The can is 0.23 cm (0.090 in.) aluminum. Other operating features of the instrument include a unimorph speaker mounted to the instrument can with an audio ON-OFF capability, fast-slow meter response, meter reset button, and a six-position switch for selecting battery check or scale multiples of X0.1, X1, X10, and X100. Each range multiplier has its own calibration potentiometer.

Most Ludlum Measurements GM probes will operate on this unit, as will many of the scintillation detectors. The external high voltage is factory set for 900 V. For special requirements, it may be adjusted for operation with any GM or scintillator tube between 400 and 1500 V.

The unit is operated with two "D" cell flashlight batteries for operation from approximately 0 to 65 °C (32 to 150 °F). For temperature operation to -18 °C (0 °F), either very fresh alkaline or rechargeable NiCd batteries may be used. Battery drain averages 17 milliamperes.

2. SPECIFICATIONS

RANGES: four linear range multiples of X0.1, X1, X10, and X100; 0-3000 μR/hr for the internal detector and 0-200 mR/hr for the external detector; meter scale representation of 0-30 μR/hr, 0-5 mR/hr, and 0-2 mR/hr (X100 range only)

METER: 1mA, 6.4 cm (2.5 in.) scale, with pivot-and-jewel suspension

METER COMPENSATION: temperature compensation is provided by thermistors on the main board

INPUT SENSITIVITY: 30 mV, (±10 mV)

HIGH VOLTAGE: externally adjustable from 400 to 1500 V

RESPONSE: typical time required for meter needle to deflect to 90% of final meter reading: 4 seconds in “F” position, 22 seconds in “S” position

LINEARITY: ±5% of full scale

INTERNAL DETECTOR: 2.5 x 2.5 cm (1 x 1 in.) NaI(Tl) scintillator

POWER: two standard "D" size batteries

BATTERY LIFE: exceeds 600 hours with a fresh set of alkaline "D" cell batteries

BATTERY DEPENDENCE: instrument calibration changes less than 3% within battery check limits on meter

AUDIO: built-in unimorph speaker with an ON-OFF switch

CONNECTOR: series "C," 706 U/G; BNC or MHV may also be provided

SIZE: 10.7 x 8.9 x 21.6 cm (4.2 x 3.5 x 8.5 in.) (H x W x L); height 24.1 cm (9.5 in.) with handle

WEIGHT: 1.4 kg (3 lb); 2 kg (4.4 lb) with external detector and batteries

FINISH: drawn-and-cast aluminum, with computer-beige polyurethane enamel and silk-screened nomenclature

3. DESCRIPTION OF CONTROLS AND FUNCTIONS

Range Multiplier Selector Switch: a six-position switch marked OFF, BAT, X100, X10, X1, X0.1. Turning the range selector switch from OFF to BAT position provides the operator a battery check of the instrument. A BAT check scale on the meter provides a visual means of checking the battery status. Moving the range selector switch to one of the range multiplier positions (X0.1, X1, X10, X100) provides the operator with typical overall ranges of 0-3000 μR/hr and 0-200 mR/hr. Multiply the scale reading by the multiplier for determining the actual reading.

AUD ON-OFF Toggle Switch: In the ON position, the switch energizes 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.

F-S Toggle Switch: Provides meter response. Selecting the fast, "F" position, of the toggle switch provides 90% of the final meter reading in four seconds. In slow, "S" position, 90% of the final meter reading takes 22 seconds. In the "F" position, there is fast response and large meter deviation. In the "S" position, there is a slow response and damped meter deviation.

RESET Pushbutton: When depressed, provides a rapid means to drive the meter to zero.

INT/EXT Switch: a two-position switch used to alternate between the internal scintillation detector and the external probe. In the INT position, the internal detector is utilized. In the EXT position, the external probe is utilized.

H.V. Adjustment: provides a means to vary the high voltage from 400 to 1500 volts. The high voltage setting may be checked at the probe connector with an appropriate voltmeter.

Range Calibration Adjustments: 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.

4. OPERATING PROCEDURES

Note: To open the Battery Lid, twist the lid button counterclockwise a quarter-turn. To close, twist clockwise a quarter-turn.

- Open the Battery Lid and install two "D" size batteries. Note (+) (-) marks on the inside of the lid. Match the battery polarity to these marks.

NOTE: The center post of flashlight battery is positive. Close the battery box lid.

- Switch the range switch to BAT. The meter should deflect to the battery check portion of the meter scale. If the meter does not respond, recheck that the batteries have proper polarity.

- Turn the INT/EXT switch to EXT.

- Connect a detector to the M3-97.

- Turn the instrument range switch to X100. Expose the detector to a check source. The speaker should click with the AUDIO ON-OFF switched to ON.

- Move the range switch to the lower scales until a meter reading is indicated. The toggle switch labeled F-S should have fast response in "F"and slow response in "S".

- Depress the RES switch. The meter should zero.

- Turn the INT/EXT switch to INT and hold the check source to the end of the can until a meter reading is indicated.

Note: To assure proper operation of the instrument between calibrations, an instrument operational check should be performed prior to use. A reference reading with a check source should be obtained at the time of initial calibration or as soon as possible afterwards, for confirming correct operation. Confirm the proper reading on each scale.

If the instrument does not read within 20% of the proper reading, it should be sent in to a calibration facility for recalibration.

5. CALIBRATION

5.1 Detector Operating Point

CAUTION: The detector operating voltage is connected to both detectors at all times, regardless of which position the detector INT/EXT switch is set. Typically an external GM type detector is used and the maximum operating voltage is 1000 Vdc; therefore, the internal detector operating voltage must be kept below 1000 Vdc.

5.1.1 Internal Detector Calibration

- Switch the INT/EXT switch to the INT position. Expose the unit to a ^{241}Am source and develop an operating voltage (HV) versus count-rate plot. Adjust the HVI potentiometer to vary the internal detector operating voltage. The operating voltage can be monitored through the external connector. Set the operating voltage at the flattest portion of this curve.

Note: Measure high voltage with a Model 500 pulser or a high-impedance voltmeter with a minimum of 1000 megohm input resistance.

- The Model 3-97 internal scintillation detector radiation response is energy dependent. An energy response curve is included in the drawing section at the back of this manual.

- Place the Model 3-97 on a certified calibration range. Use the indentations on the sides of the can to position the internal detector to the center of the calibration line. Calibrate each scale for the best fit at two-thirds and one-third-scale readings (10 and 20 μR/hr). Confirm that the calibration is within 10% of each reading.

If the appropriate radiation fields are not available, switch the instrument to the lowest calibrated range position and perform the following:

- Connect a Ludlum Model 500 Pulser to the external connector and switch the INT/EXT switch to the EXT position.

- With the Model 3-97 switch to the lowest calibrated range position, determine the pulse rate versus μR/hr calibration point. Decade the pulser and Model 3-97 to the next lower range and calibrate the meter to the corresponding point determined in the previous step. Decade down and calibrate the remaining range positions.

After all the range positions are calibrated, monitor the background radiation level. Typical radiation background levels range from 5-10 μR/hr.

5.1.2 External Detector Calibration

For most external GM detector applications, the detector operating may be adjusted for 900 Vdc. Set the HV to the recommended detector operating voltage.

- Place the external GM detector on a certified calibration range. Check each range position at three-fourths and one-fourth-scale and confirm the reading is within 10%. If the reading error is greater than 10% but less than 20% of reading, record the field versus the meter reading at three-fourths and one-fourth scale. State the correction factor on the calibration sticker for the specific range.

5.1.3 CPM and mR/hr Meterface

- For the combination CPM and mR/hr meter face, calibrate the external detector with a calibrated certified range. Record the field versus CPM meter reading for the internal detector at various points on the calibration range.

6. MAINTENANCE

Instrument maintenance consists of keeping the instrument clean and periodically checking the batteries and the calibration.

To assure proper operation of the instrument between calibrations, the instrument should be tested with a check source prior to each use. A reference reading should be obtained when exposed to the check source in a constant and reproducible manner at the time of calibration. If the instrument response differs from the reference reading by more than 20%, the instrument should be returned to a calibration facility for maintenance, repair, or recalibration, as required.

Recalibration should be accomplished after any maintenance or adjustment of any kind has been performed on the instrument. Battery replacements are not considered to be maintenance and do not normally require the instrument to be recalibrated.

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

The batteries should be removed and the battery contacts cleaned of any corrosion at least every three months. If the instrument has been exposed to a very dusty or corrosive atmosphere, more frequent battery servicing should be used.
Use a spanner wrench to unscrew the battery contact insulators, exposing the internal contacts and battery springs. Removing the handle will facilitate access to these contacts.

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

7. THEORY OF OPERATION

7.1 Input

The external detector pulses are coupled from the detector through C3 to emitter follower Q5. R10 and R20 provide bias. R32 protects Q5 from input shorts. R38 couples the detector to the high-voltage supply.

The internal detector (V1) pulses are coupled from the detector through C27 to emitter follower Q7. R21 and R41 provide bias to Q7. R40 protects Q7 from input shorts. R39 couples V1 to the high-voltage supply.

The internal detector is used only when the INT/EXT switch is in the INT position. In the EXT position, the external detector is used. When in the EXT position, P1-13 is grounded, turning off Q6, allowing the pulses from Q5 to pass on to the amplifier. P1-14 is opened, allowing R4 to bias Q8, pulling the pulses from the base of Q7 to ground and blocking them from the amplifier. In the INT position, P1-14 is grounded, turning off Q8, allowing the pulses from Q7 to pass on to the amplifier. P1-13 is opened allowing R47 to bias Q6, pulling the pulses from the base of Q5 to ground and blocking them from the amplifier.

7.2 Amplifier

A self-biased amplifier provides gain in proportion to R33, divided by R6 for the external detector and R33, divided by R44 for the internal detector. Pins 1, 2, and 6 of U9A provide amplification. U1 is coupled as a current mirror to provide a load for U4. The output self-biases to 2 Vbe (approximately 1.4 volts) at pin 1 of U4. This provides just enough bias current through pin 3 of U4 to conduct all of the current from the current mirror.

Positive pulses from pin 7 of U4 are coupled to the discriminator.

7.3 Discriminator

Comparator U5 provides discrimination. The discriminator is set by the voltage divider, R8 and R5, coupled to pin 3 of U5. The comparator output pulses are coupled to pin 5 of U6 for meter drive and pin 12 of U6 for audio.

7.4 Audio

Discriminator pulses are coupled to univibrator pin 12 of U6. Front panel audio ON-OFF selector controls the reset at pin 13 of U6. When ON, pulses from pin 10 of U6 turn on oscillator U2, which drives the can-mounted unimorph. The speaker tone is set by R13 and C12; duration by R36 and C23.

7.5 Digital Analog Convertor

Pins 10-15 of U1 are coupled as a current mirror. For each pulse of current through R9, an equal current is delivered to C22. This charge is drained off by R42. The voltage across C22 is proportional to the incoming count rate.

7.6 Scale Ranging

Detector pulses from the discriminator are coupled to univibrator pin 5 of U6. For each scale change, the pulse width of pin 6 of U6 is changed by a factor of 10, with the actual pulse width being controlled by the front-panel calibration controls and their related capacitors. This arrangement allows the same current to be delivered to C22 by one-tenth of a count on the X.1 range as 100 counts on X1K range.

7.7 Meter Drive

The meter is driven by the emitter of Q3, coupled as a voltage follower in conjunction with pin 1 of U3. For the battery test, the voltage follower is bypassed, and the meter movement is directly coupled to the battery through R26.

7.8 Meter Compensation

When the unit is provided with a high-torque meter movement, with 1.2 V drive, a temperature compensation circuit is provided on the main circuit board by way of components R15, R17, and R23.

7.9 Fast/Slow Time Constant

For the slow time constant, C29 is switched from the output of the meter drive to parallel C22.

7.10 Low Voltage Supply

Battery voltage is coupled to U8 and associated components (a switching regulator) to provide 5 V at pin 5 to power all logic circuits. Unregulated battery voltage is used to power the meter drive (Q3) and the high-voltage blocking oscillator (Q2).

7.11 Low Voltage Reference

U7 provides a 1.22 V precision reference for HV supply and discriminator reference.

7.12 High Voltage Supply

High voltage is developed by blocking oscillator Q2-T1 and rectified by voltage multiplier CR1, CR2, CR3, and CR4. Output voltage increases as current through Q1 increases, with maximum output voltage with Q1 saturated.

High voltage is coupled back through R12 to pin 6 of opamp U3. R2 completes the high-voltage circuit-to-ground. High-voltage output is accomplished by setting the bias of pin 5 of U3 with R5 (internal) or R7 (external), located on the calibration circuit board. During stable operation, the voltage at pin 6 of U3 will equal the voltage at pin 5 of U3. Pin 7 of U3 will cause conduction of Q1 to increase or decrease until the high voltage seeks a level of stability.

PARTS LIST

Ref. No.	Description	Part No.
Model 3-97 Survey Meter		
UNIT	Completely Assembled Model 3-97 Survey Meter	48-1410
Main Circuit Board, Drawing 464 x 633		
BOARD	Assembled Circuit Board	5464-633
CAPACITORS		
C1	0.0015µF, 3kV, C	04-5518
C2	0.01µF, 100V, C	04-5523
C3	100pF, 3kV	04-5532
C4	0.0027µF, 3kV, C	04-5520
C5	220pF, 100V, C	04-5530
C6-C7	0.0015µF, 3kV, C	04-5518
C8	0.001µF, 100V, C	04-5519
C9	100µF, 10V, DT	04-5576
C10	100pF, 3kV	04-5532
C11	0.0015µF, 3kV, C	04-5518
C12	470pF, 100V, C	04-5555
C13	0.01µF, 100V, C	04-5523
C14	1µF, 35V, DT	04-5575
C15	0.1µF, 100V, C	04-5521
C16-C17	100µF, 10V, DT	04-5576
C18	330pF, 100V	04-5531
C19	10µF, 20V, DT	04-5592
C20	220pF, 100V, C	04-5530
C21	100pF, 100V, C	04-5527
C22	10µF, 20V, DT	04-5592
C23	0.01µF, 100V, C	04-5523
C24	100µF, 10V, DT	04-5576
C25	0.1µF, 35V, DT	04-5574
C27	100pF, 3kV, C	04-5532
C29	47µF, 16V, DT	04-5550
C30	0.1µF, 35V, DT	04-5574
TRANSISTORS		
Q1	2N3904G	05-5755
Q2	2N4402BU	05-5763
Q3	2N3904G	05-5755
Q4	2N4402BU	05-5763
Q5-Q7	2N3904G	05-5755
Q8	2N7000	05-5820
INTEGRATED CIRCUITS		
U1	CMXT3906TRLF	05-5890
U2	ICM7555	06-6136
U3	TLC27M7IP	06-6248
U4	CMXT3904TRLF	05-5888
U5	TLC372IP	06-6265
U6	CD4098BE	06-6066
U7	LM385Z-1.2	05-5808
U8	MAX631	06-6249
U9	CMXT3904TRLF	05-5888
U10	CMXT3906TRLF	05-5890
U11	CMXT3904TRLF	05-5888
DIODES		
CR1-CR4	1N4007	07-6274
CR5	1N4148	07-6272
RESISTORS		
R1-R2	1M, 250mW, 5%	10-7028
R3	10k, 250mW, 5%	10-7016
R4	22k, 250mW, 5%	10-7070
R5	10k, 250mW, 5%	10-7016
R6-R7	4.7k, 250mW, 5%	10-7014
R8	43k, 250mW, 5%	10-7057
R9	33k, 250mW, 5%	10-7019
R10	100k, 250mW, 5%	10-7023
R11	10k, 250mW, 5%	10-7016
R12	1 G, FHV-1, 2%	12-7686
R13	470k, 250mW, 5%	10-7026
R14	10k, 250mW, 5%	10-7016
R16	1k, 250mW, 5%	10-7009
R17	301 OHM, 400mW, 1%	12-7855
R18	47k, 250mW, 5%	10-7020
R19	1k, 250mW, 5%	10-7009
R20-R21	100k, 250mW, 5%	10-7023
R22	10k, 250mW, 5%	10-7016
R24	200 OHM, 250mW, 5%	10-7006
R25	2.2k, 250mW, 5%	10-7012
R26	2.37k, 1/8W, 1%	12-7648
R27	22k, 125mW, 5%	10-7070
R28	100 OHM, 250mW, 5%	10-7004
R29	8.2k, 250mW, 5%	10-7015
R30	100k, 250mW, 5%	10-7023
R31	1k, 1/4W, 5%	10-7009
R32	10k, 250mW, 5%	10-7016
R33	82k, 250mW, 5%	10-7022
R34	10k, 1/4W, 5%	10-7016
R35	100k, 250mW, 5%	10-7023
R36	2.7M, 250mW, 5%	10-7029
R37	1k, 250mW, 5%	10-7009
R38	1M, 333mW, 1%	12-7609
R39	33k, 250mW, 5%	10-7019
R40	10k, 250mW, 5%	10-7016
R41	100k, 250mW, 5%	10-7023
R42	180k, 250mW, 5%	10-7068
R44	4.7k, 250mW, 5%	10-7014

Ref. No.	Description	Part No.
R47	100k, 250mW, 5%	10-7023
R48	10M, 250mW, 5%	10-7031
THERMISTORS		
RT15	150 Ohm, 333mW, 2%	07-6332
RT23	150 Ohm, 333mW, 2%	07-6332
INDUCTORS		
L1	470UHY	21-9600
TRANSFORMERS		
T1	L8050	40-0902
MISCELLANEOUS		
W2-W9.	RECEPTACLE Cloverleaf 011-6809	18-8771
P1	CONN-1-640456-6 MTA100X16	13-8134
P2	CONN-640456-2 MTA100X2	13-8073
J1	CONTACT#1414	18-9124
J2	JACK-TEST 1128-09-0319	18-8806

Calibration Board, Drawing 363 X 528

BOARD	Completely Assembled Calibration Board	5363-674
CAPACITORS		
C1	0.047ΦF 100V C X7R	04-5565
C2	0.0047ΦF 100V C X7R	04-5570
RESISTORS		
R1-R2	1 Meg Trimmer	09-6814
R3	100k Trimmer	09-6813
R4	1 Meg Trimmer	09-6814
R5	100k Trimmer	09-6813
R7	100k Trimmer	09-6813
RESISTOR NETWORK		
RN1	NETWORK-10k SIP 8PIN	12-7720
MISCELLANEOUS		
P3	CONN-640456-5 MTA100	13-8057
P4	CONN-640456-4 MTA100	13-8088

Ref. No.	Description	Part No.

Chassis Wiring Diagram, Drawing 363 X 582

AUDIO		
DS1	UNIMORPH 60690	21-9251
CONNECTOR		
J1	CONN-1-640442-6 MTA100	13-8187
J2	CONN-640442-2 MTA100	13-8178
J3	CONN-640442-5 MTA100	13-8140
J4	CONN-640442-4 MTA100	13-8170
J5	RECPT-UG706/U "C"	13-7751
SWITCHES		
S1	Centerlab PA600-210	08-6501
S2	55D36-01-2-AJN	08-6514
S3-S4	7101-SYZ-QE	08-6511
S6	30-1 P/B	08-6517
BATTERY		
B1-B2	"D" Duracell Battery	21-9313
DETECTOR		
V1	Model 12S/19/3-97 DETECTOR	47-1574
	X-TAL/TUBE ASSEMBLY-12S ADIT	2004-061
MISCELLANEOUS		
*	PORTABLE BATTERY NEGATIVE CONTACT ASSY	2001-065
*	PORTABLE BATTERY POSITIVE CONTACT ASSY	2001-066
M1	PORT BEZEL FRONT PANEL ASSY	4363-188
*	PORT DEEP CAN ASSEMBLY	4363-615
*	Model 3-97 CASTING	9363-913
*	Model 3-97/3-98 MAIN HARNESS	8363-700
*	PORTABLE KNOB	08-6613

Ref. No.	Description	Part No.
*	PROBE KNOB-MS 91528	08-6606
*	PORT BEZEL GLASS W/O SCREWS	4363-352
*	METER MOVEMENT (1mA)	15-8030
*	PORTABLE METER FACE	7363-136
*	HARNESS-PORT CAN WIRES	8363-462
*	PORTABLE BATTERLY LID WITH STAINLESS CONTACT	2009-036
.*	PORT. LATCH KIT W/O BATT. LID	4363-349
*	PORT. CALIB. COVER W/SCREWS	9363-200
*	PORT. HANDLE (ROLLED) W/SCREWS	7363-139
*	PORT HANDLE FOR CLIP W/SCREWS	7363-203
*	REPLACEMENT CABLE (STD 39 inch)	40-1004
*	CLIP (44-6 TYPE) W/SCREWS	7010-008-01

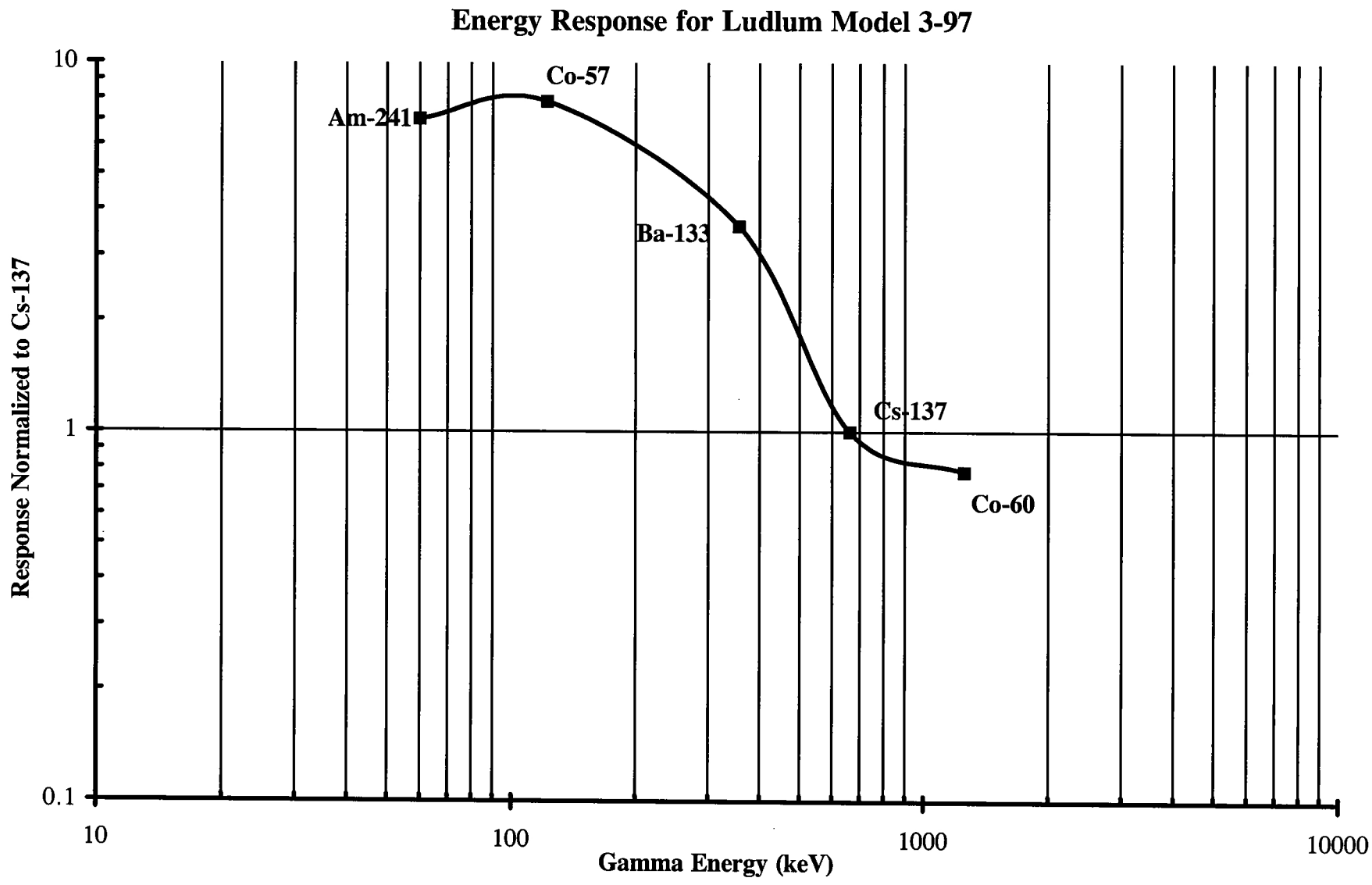
DRAWINGS AND DIAGRAMS

Energy Response Curve for Model 3-97 (Internal Detector)

Main Circuit Board, Drawing 464 x 633
Main Circuit Board Component Layout, Drawing 464 x 636 (2 sheets)

Calibration Board, Drawing 363 x 528
Calibration Board Component Layout, 363 x 529 (2 sheets)

Wiring Diagram, Drawing 363 x 527


Energy Response for Ludlum Model 3-97
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Am-241
Co-57
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Co-60
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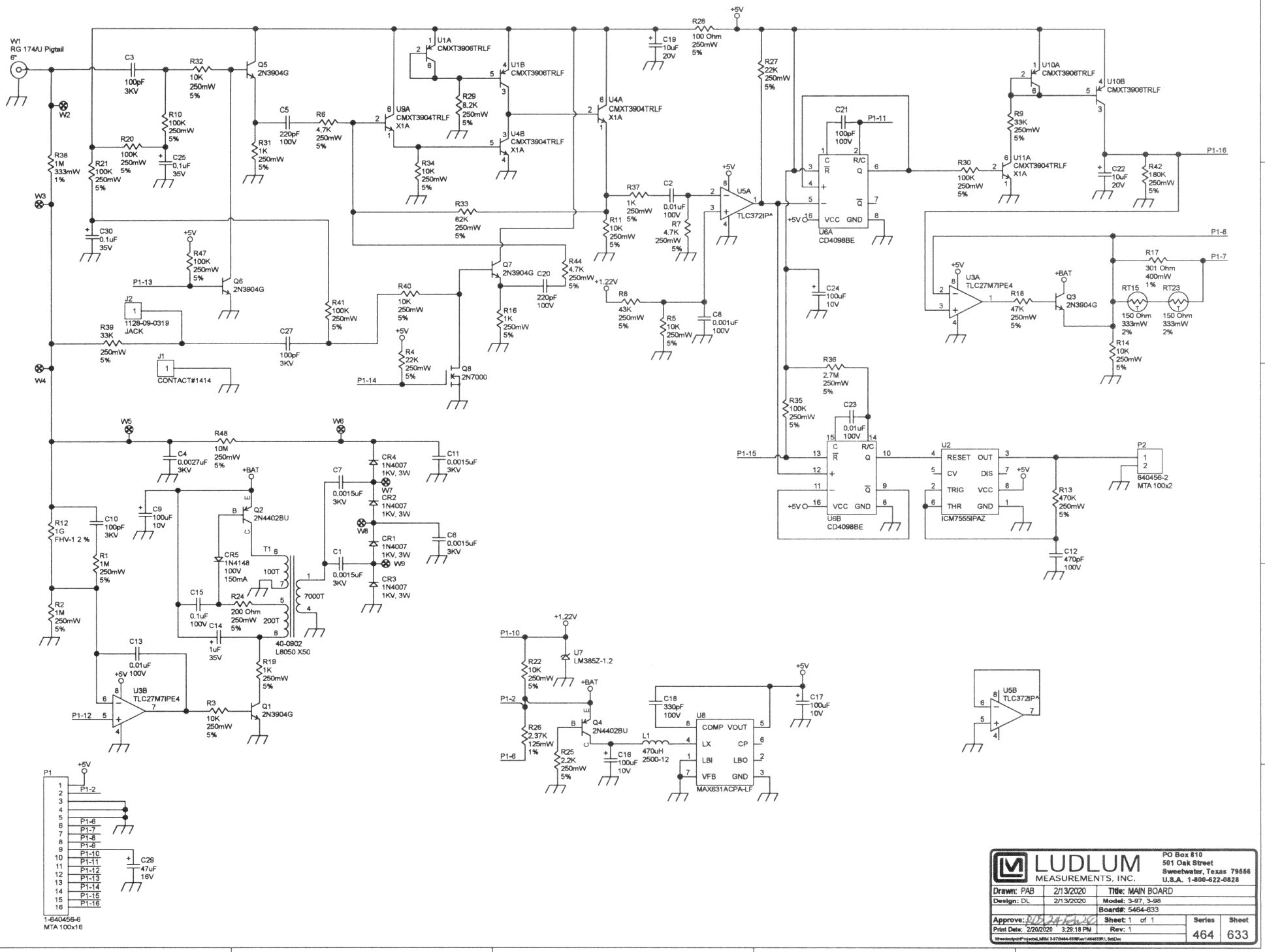

LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-622-0828

Drawn: PAB	2/13/2020	Title: MAIN BOARD	
Design: DL	2/13/2020	Model: 3-97, 3-98	
		Board#: 5464-633	
Approve:		Sheet: 1 of 1	Series 464 / Sheet 633
Print Date: 2/20/2020 3:29:18 PM		Rev: 1	

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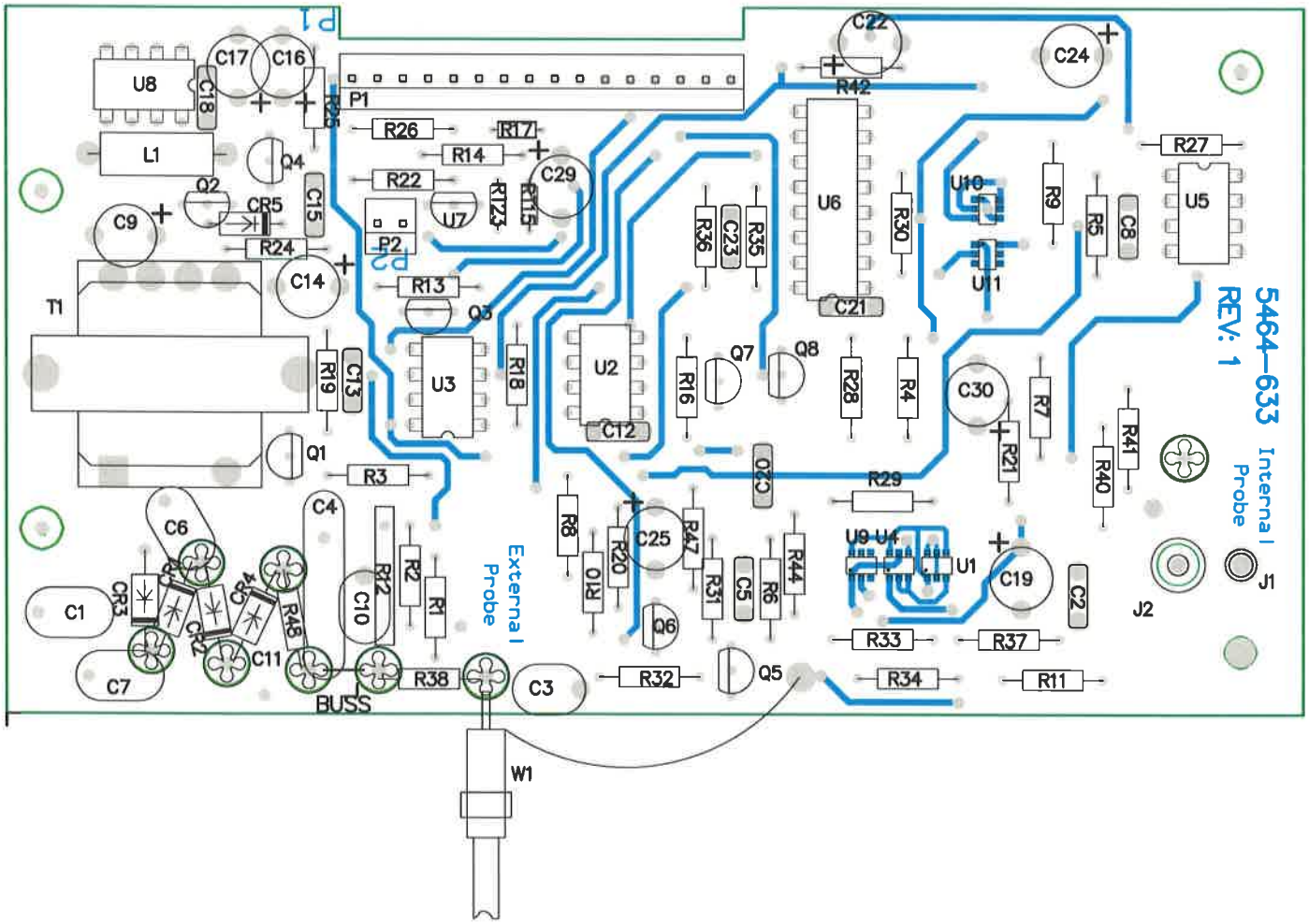

LUDLUM MEASUREMENTS, INC.	PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828		
Title: MAIN BOARD			
Drawn: PAB	2/13/2020	**Model:** 3-97, 3-98	
Design: DL	2/13/2020	**Board#:** 5464-633	
Approve: RDS	24 Feb 20	**Rev:** 1	
PCBA Drawing		**SCALE: 1.08**	**Series** 464 / **Sheet** 636
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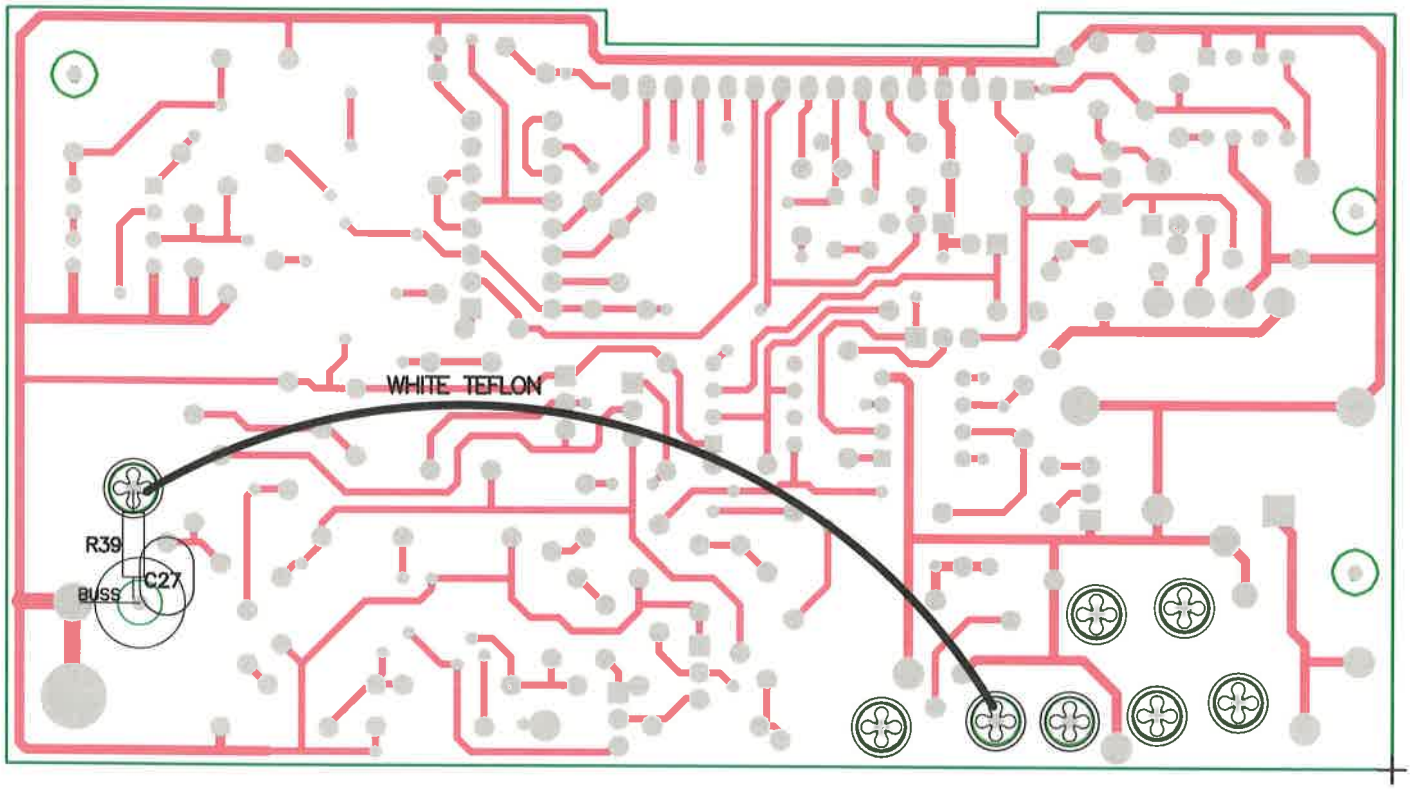

LUDLUM MEASUREMENTS, INC.	PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828		
Title: MAIN BOARD			
Drawn: PAB	2/13/2020	**Model:** 3-97, 3-98	
Design: DL	2/13/2020	**Board#:** 5464-633	
Approve: RDS	24 Feb 20	**Rev:** 1	
PCBA Drawing		**SCALE: 1.08**	**Series** 464 / **Sheet** 636
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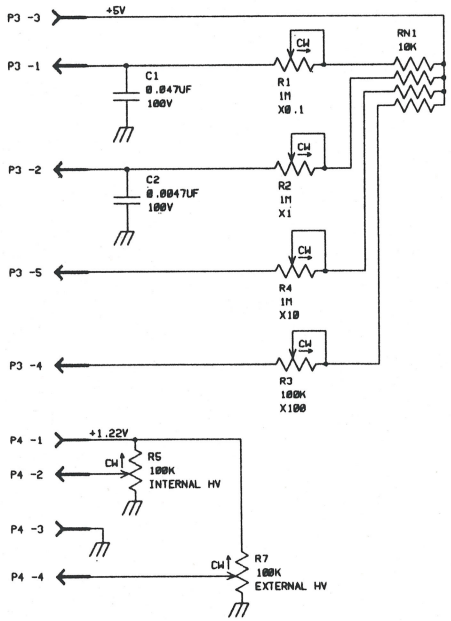
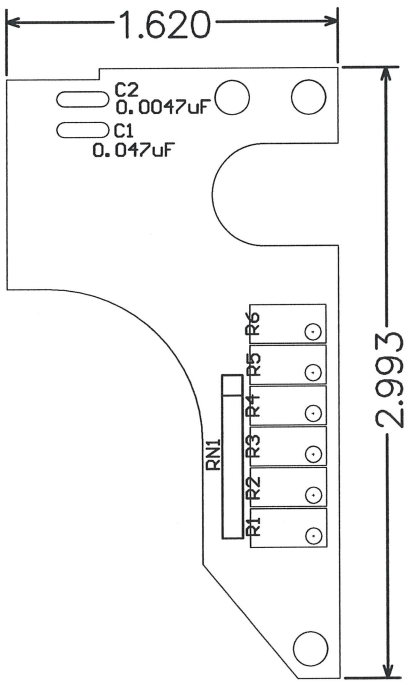
REVISIONS						
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED



UPDATED -	/ /	LUDLUM MEASUREMENTS INC.
DR CKD	04/07/92	TITLE: CALIBRATION BOARD
CHK P.W.	10/1/92	
DSGN -	/ /	BOARD# 5363-674
APPD JGW	10/1/92	SIZE D / MODEL J-97 & J-98 / SERIES J63 / SHEET 528
NEXT HIGHER ASSY. -		
14:37:48	9-Sep-92	SB363674 / SHEET 1 OF 1



LUDLUM MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
Title: CALIBRATION BOARD			
Drawn: CKB	06/18/2001	**Model:** 3-97/3-98	
Design: DL	06/18/2001	**Board#:** 5363-674	
Approve: JMC	17OCT13	**Rev:** 1	
Print Date: 10/17/2012 11:17:06 AM		**SCALE: 1.00** Top Overlay	**Series** 363 / **Sheet** 529
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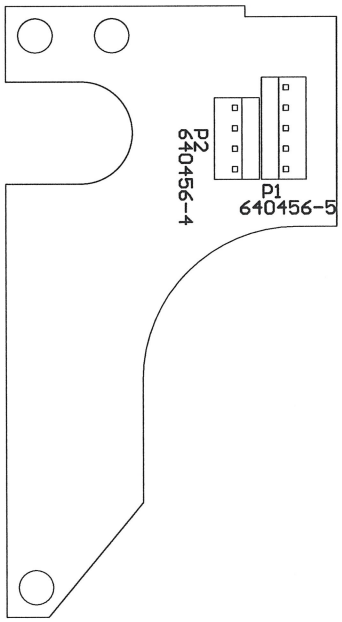

LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, TX 79556
U.S.A. 1-800-622-0828

Title: CALIBRATION BOARD		
Drawn: CKB	06/18/2001	**Model:** 3-97/3-98
Design: DL	06/18/2001	**Board#:** 5363-674
Approve: JMC	17OCT12	**Rev:** 1
Print Date: 10/17/2012 11:17:06 AM		**SCALE: 1.00** Bottom Overlay; **Series** 363; **Sheet** 529

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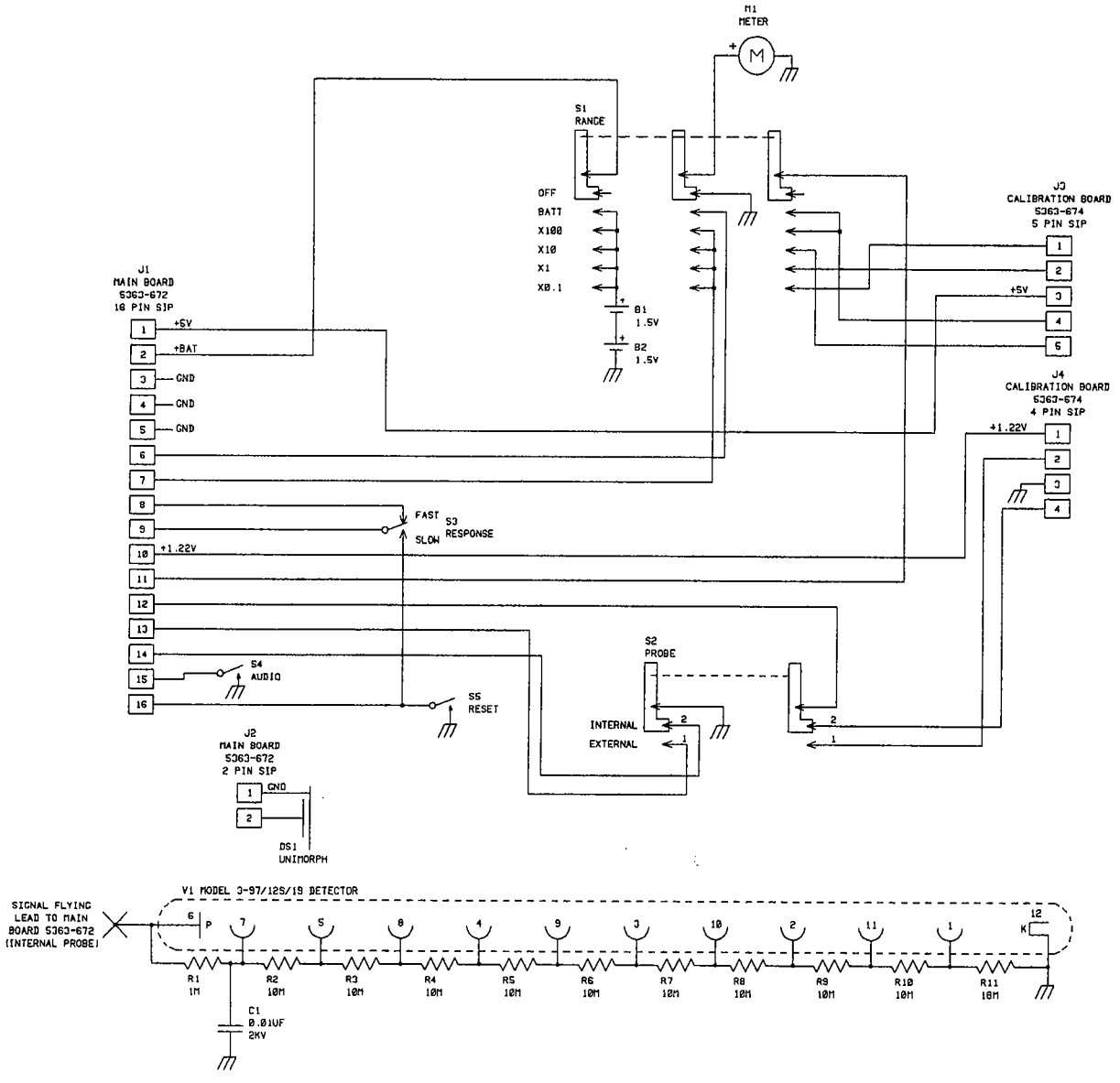
REVISIONS						
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED



UPDATED -	/ /	LUDLUM MEASUREMENTS INC.	
DR CKB	08/28/92	TITLE: WIRING DIAGRAM	
CHK DW	10/9		
DSGN -	/ /	BOARD# 363-673	
APPD JGW	11/6/92	SIZE D / MODEL 3-97	SERIES 363 / SHEET 627
NEXT HIGHER ASSY. -			
11:28:01	13-Jan-93	S8363673	SHEET 1 OF 1