

LUDLUM MODEL 19A

Micro R Meter

May 2017

**Serial No. 144020 and Succeeding
Serial Numbers**

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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.

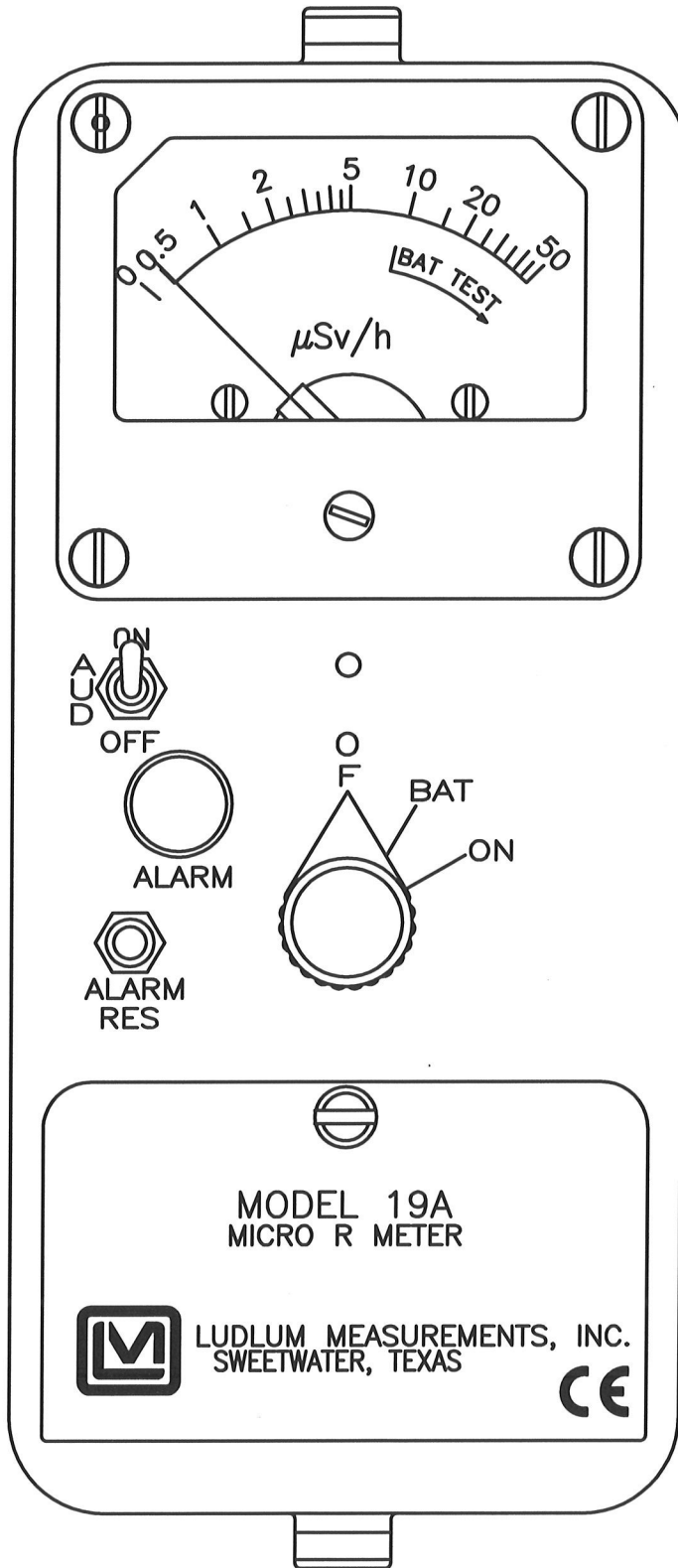
RETURN OF GOODS TO MANUFACTURER

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**

REV #	ALTERATIONS	DATE	BY
	VALID	03/11/03	PW



4367-164

DWN	DATE	CHECKED	APPROVED
PW	03/11/03		<i>blwell</i> 3-11-03
TITLE: M 19A SURVEY METER			
LUDLUM MEASUREMENTS, INC. 501 DMC STREET SWEETWATER, TEXAS 75086		SERIES 367	SHEET 164

Model 19A Micro R Meter

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Model 19A Micro R Meter

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1. GENERAL

The Ludlum Model 19A Micro R Meter is a portable survey instrument having the additional feature of an audio and visual alarm. The alarm circuit is adjustable from a meter scale deflection of 0 to off scale. The meter scale is logarithmic with a range of 0-500 $\mu\text{R/hr}$ or 0-5 $\mu\text{Sv/h}$. (The unit is available in either $\mu\text{R/hr}$ or $\mu\text{Sv/h}$.)

The Model 19A utilizes an internally-mounted 2.5 x 2.5 cm (1 x 1 in.) NaI (Tl) scintillator to offer an optimum performance in counting low-level gamma radiation. It is designed to be moisture and dust resistant.

The unit body is made of cast aluminum, including the meter housing. The meter housing is a rugged aluminum bezel with waterproof seals. The can is 2.3 cm (0.90 in.)

aluminum. Other operating features of the instrument include a unimorph speaker mounted to the instrument can with an audio ON-OFF capability, alarm reset push-button switch, and a three-position switch for selecting battery check or instrument ON.

The instrument is capable of using either standard D cell batteries or nickel-cadmium rechargeable batteries. However, the 19A does not include circuitry for recharging the batteries.

All controls, including a calibration potentiometer, are internal. Two D cell batteries are located in an isolated compartment and easily changed from the front panel.

2. SPECIFICATIONS

LINEARITY: $\pm 10\%$ of full scale

INPUT IMPEDANCE: 0.1 megohm

HIGH VOLTAGE: variable from 400-1500 Vdc, electronically regulated to within $\pm 1\%$

CALIBRATION STABILITY: less than 3% variance to battery end point

SENSITIVITY: 30 ± 10 mV

BATTERY COMPLEMENT: two standard size "D" cell batteries, secured in a isolated compartment with screws and a gasket for dust and moisture proofing

BATTERY LIFE: exceeds 600 hours with a fresh set of Alkaline "D" cell batteries (non-alarm condition)

AUDIO OUTPUT: built-in unimorph speaker and ON-OFF switch provided on front panel

ALARM INDICATION: audio and visual

indication when above alarm threshold

ALARM RANGE: 0 to off-scale

COUNTING RANGE: 0-500 $\mu\text{R/hr}$ or 0-5 $\mu\text{Sv/h}$

RESPONSE: dependent on number of counts present (typically not greater than 7 seconds from 10% to 90% of final reading)

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

DETECTOR: photomultiplier coupled to a 2.5 x 2.5 cm (1 x 1 in.) NaI (Tl) crystal mounted inside the instrument housing

FINISH: drawn-and-cast aluminum fabrication with beige powder coating

SIZE: 19.8 x 8.9 x 21.6 cm (7.8 x 3.5 x 8.5 in.) (H x W x L), with handle

WEIGHT: 2.1 kg (4.5 lb), including batteries

3. DESCRIPTION OF CONTROLS AND FUNCTIONS

OFF-BAT-ON Selector Switch: A three-position switch for turning the instrument on and checking the battery status. A BAT TEST scale on the meter provides a visual means of checking the battery when the switch is in the BAT position. The ON position provides power to the instrument.

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 is,

the higher the audio frequency. The audio should be turned OFF when not required to reduce battery drain.

ALARM RES Pushbutton Switch: When depressed, this switch resets the alarm when the meter pointer is below the alarm threshold.

ALARM Light: A red lamp that comes on to give a visual alarm when radiation is above the alarm threshold.

4. OPERATING PROCEDURES

The Model 19A is a simple instrument to operate. All controls are located on the front panel along with the battery compartment. The 2.5 x 2.5 cm (1 x 1 in.) NaI (Tl) Scintillator is mounted internally.

NOTE: To open the battery lid, twist the lid button counter-clockwise one quarter of a turn. To close, twist clockwise a quarter of a turn.

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

NOTE: Center post of flashlight battery is positive.

- Close the battery box lid.
- Select the BAT position of the OFF-BAT-ON switch. Replace the batteries if the meter pointer is below the BAT TEST line.
- Check for audio indication with the AUD ON-OFF switch.

- Check the instrument for the proper meter scale indication with a known source.

NOTE: Instrument response time will vary with the radiation field intensity. Refer to the RESPONSE time in Section 2.

- Position a check source to drive meter to alarm set point (set at 20-50 $\mu\text{R/hr}$ or 0.20-0.50 $\mu\text{Sv/h}$ at factory) causing instrument to alarm. Remove check source and depress the ALARM RES pushbutton to confirm that alarm will reset.

- The instrument is ready for monitoring.

5. CALIBRATION

The Model 19A radiation response is energy-sensitive. The detector plateau-characteristic must be determined for the anticipated radiation nuclide. The following is an example calibration:

- Remove the instrument from its case (referred to as "can" from hereon).
- Adjust Alarm Set control fully clockwise to keep the alarm circuit from tripping during calibration.
- With the instrument off, remove the detector coax cable connection at the junction of C57-R27 on the circuit board.
- Connect a Ludlum Model 500 Pulser to the C57-R27 junction.
- Set the pulse height at -80 mV.
- Calibrate the scales as shown in Table 1. Use the CAL control for the mid scale or lower meter reading and the SPAN control for the upper meter reading. Alternate between the two controls to ensure meter linearity between readings.

Table I

READING	PULSES/MINUTE
5	875
50	8,750
500	87,500

- Reconnect detector coax to the junction of C57-R27. Replace instrument can.

NOTE: The detector is not light-tight outside

of the can.

- Plateau instrument with ²⁴¹Americium using the HV adjust potentiometer.
- Determine the plateau center voltage.
- Remove can.
- Measure detector operating voltage at C57-R27 and record for future reference.

NOTE: Measure high voltage with a Model 500 pulser or a high-impedance voltmeter with a high-meg probe. If one of these instruments is not available, use a voltmeter with a minimum of 1000 megohm input resistance.

- Replace instrument can.
- Take the Model 19A to a certified calibration range. Place the instrument in a 100µR/hr (1 µSv/h) (exposure rate) radiation field. The depression at the front of the instrument can indicates the detector axis center, and approximately 1.9 cm (0.75 in.) from the depression end is the detector 2.5 x 2.5 cm (1 x 1 in.) NaI scintillator center. Expose the radiation source and adjust the CAL control (located on the calibration board inside instrument can) for the correct meter indication.
- Place the instrument in a calibrated 500 µR/hr (5 µSv/h) radiation field. Adjust the SPAN control for correct meter reading.
- Confirm instrument linearity by placing the instrument back in 100 µR/hr (1 µSv/h) field. If the meter is non-linear, alternate between the CAL and SPAN controls for meter correction. Adjust the Cal control for the lower reading and the

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- SPAN control for the upper reading.
- Position meter pointer at the desired alarm set point with radiation source. Adjust the ALARM SET control to the desired alarm threshold. Minimum setting is 0 on the meter scale and maximum setting is full-scale deflection. (Factory set at 20-50 $\mu\text{R/hr}$ or 0.20-0.50 $\mu\text{Sv/h.}$)
- When the alarm circuit is energized, both the audio and visual indications should occur. Depressing the ALARM RES push-button switch resets the alarm circuit when the meter pointer is below the alarm threshold.
- Recheck all operating functions of the instrument prior to use.

6. MAINTENANCE

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

An instrument operational check should be performed prior to each use by exposing the detector to a known source and confirming the proper reading on each scale.

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 37.8 °C (100 °F).

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PARTS LIST

Ref. No.	Description	Part No.
Model 19A Ratemeter		
UNIT	Completely Assembled Model 19A Micro R Meter	48-2117
Circuit Board, Drawing 363 X 440		
BOARD	Assembled Circuit Board	5363-602
CAPACITORS		
C38	0.0015 μ F, 3KV, C	04-5518
C40	0.0015 μ F, 3KV, C	04-5518
C41	0.0015 μ F, 3KV, C	04-5518
C42	0.0027 μ F, 3KV, C	04-5520
C50	100pF, 3KV, C	04-5532
C56	100 μ F, 10V, DT	04-5576
C57	100pF, 3kV, C	04-5532
C102	100 μ F, 10V, DT	04-5576
C103	10 μ F, 20V, DT	04-5592
C106	0.001 μ F, 100V, C	04-5519
C109	0.01 μ F, 100V, C	04-5523
C112	470pF, 100V, C	04-5555
C113	0.01 μ F, 100V, C	04-5523
C115	100 μ F, 10V, DT	04-5576
C117	100pF, 100V, C	04-5527
C119	0.001 μ F, 100V, C	04-5519
C121	330pF, 100V, C	04-5531
C126	10 μ F, 20V, DT	04-5592
C134	100 μ F, 10V, DT	04-5576
C163	0.01 μ F, 100V, C	04-5523
C170	0.1 μ F, 100V, C	04-5521
C171	1 μ F, 35V, DT	04-5575
C191	0.0015 μ F, 3KV, C	04-5518
C200	4.7 μ F, 10V, DT	04-5578
C226-C227	0.01 μ F, 100V, C	04-5523
C228	0.1 μ F, 35V, DT	04-5574
TRANSISTORS		
Q6	2N3904	05-5755
Q15	MPS6534	05-5763

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Q44	2N3904	05-5755
Q96	2N3904	05-5755
Q145	MPS6534	05-5763
Q218	MPSW01	05-5778
Q224	MPS6534	05-5763
Q225	2N3904	05-5755

INTEGRATED CIRCUITS

U1	CA3096	06-6023
U2	TLC372	06-6265
U3	CD4098	06-6066
U4	CA3096	06-6023
U5	ICM7555	06-6136
U6	TLC27M7IP	06-6248
U7	MAX631	06-6249
U101	LM385Z-1.2	05-5808
U198	TLC27M7IP	06-6248

DIODES

CR94	1N4148	07-6272
CR166-CR167	1N4007	07-6274
CR169	1N4007	07-6274
CR175	1N4007	07-6274
CR201-CR202	1N4148	07-6272

RESISTORS

R18	1k	10-7009
R27	22k	10-7070
R36	10M	10-7031
R46	10k	10-7016
R47	1G	12-7686
R63	82k	10-7022
R64	1k	10-7009
R65	10k	10-7016
R66	1k	10-7009
R68	8.2k	10-7015
R70	4.7k	10-7014
R72	SAT (TYPICALLY 33k for μ R version and 82k for μ Sv version)	
R75	33k	10-7019
R76	100 OHM	10-7004
R77	2.2k	10-7012
R78	22k	10-7070
R79	100k	10-7023

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R81	10k	10-7016
R83	100k	10-7023
R84	470k	10-7026
R86	2.7M	10-7029
R87	10k	10-7016
R89	100k	10-7023
R91	4.7k	10-7014
R128	100k	10-7023
R137	10k	10-7016
R138	1M	10-7028
R147	SAT (TYPICALLY 750k)	
R150	SAT (TYPICALLY 2.2k)	
R159	10k	10-7016
R172	47k	10-7020
R177	200 OHM	10-7006
R189	200 OHM	10-7006
R196	1k	10-7009
R204	1M	10-7028
R205	100k	10-7023
R206	22k	10-7070
R207	5.6k	10-7042
R208	24.3k	12-7700
R209-R210	294k	12-7632
R212	100k	10-7023
R213	1k	10-7009
R214	24.3k	12-7700
R215	SAT (TYPICALLY 10k)	
R216-R217	100M	10-7036
TRANSFORMERS		
T165	L8050	40-0902
INDUCTORS		
L13	IM6-470UH-5	21-9600
MISCELLANEOUS		
*	CLOVERLEAF RECEPTACLES 011-6809 (6 EACH)	18-8771
*	WALDON 16-06-0007 LARGE RECEPTACLE	18-8792
*	JACK-TEST 1128-09-0319	18-8806
*	SPACER-423-175 (2 EA)	18-8992

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Calibration Board, Drawing 367 x 48

BOARD	Assembled Calibration Board	5367-064
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RESISTORS

R1-R2	100k TRIMMER	09-6823
R3	500 OHM TRIMMER	09-6848
R4	10k	10-7016
R5	100k TRIMMER	09-6823
R6	100k	10-7023

MISCELLANEOUS

P1	CONN-640456-8 MTA100	13-8039
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Wiring Diagram, Drawing 367 X 47

AUDIO

DS2	UNIMORPH 101-001	21-9251
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CONNECTORS

J1	CONN-1-640442-3 MTA100	13-8138
J2	CONN-640442-2 MTA100	13-8178
J3	CONN-640442-8 MTA100	13-8184

SWITCHES

S1	PA-600-210	08-6501
S2	30-1-PB GRAYHILL	08-6517
S3	7101-SYZ-QE	08-6511

BATTERY

B1-B2	BATTERY-DURACELL "D"	21-9313
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MISCELLANEOUS

DS1	BULB-3338	21-9307
*	LAMP-HOLDER	
	101-8430-09-201	21-9410
*	LENS-RED 140-1471	21-9411
M1	PORT BEZEL W/MOV ASSY	4363-188
*	METER BEZEL W/GLASS	
	W/O SCREWS	4363-352

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*	METER MVMNT	
	919492 1 mA	15-8030
*	M19A BATTERY BOX LID	9367-125
	W/CE	
*	BATTERY CONTACT ASSY	2001-042
*	DEEP PORTABLE CAN	
	ASSY	4363-615
*	M19A CASTING	9367-055
*	M19A MAIN HARNESS	8367-065
*	PORTABLE KNOB	08-6613
*	BATTERY LID W/LATCH	
	SET	9367-032
*	PORT LATCH KIT W/O	
	BATTERY LID	4363-349
*	SWITCH SEAL (TOGGLE)	08-6610
*	SWITCH SEAL (P/B)	08-6611
*	REPLACEMENT DETECTOR	
	ASSY	47-1574
*	X-TAL TUBE ASSY- M12S	2004-061
*	PM TUBE 2.9 cm (1.1 in.)	01-5367
*	CAL COVER W/SCREWS	9363-200

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DRAWINGS AND DIAGRAMS

Front of Manual:

Model 19A Micro Sieverts Front Panel, Drawing 367 x 167

Back of Manual:

*Main Board, Drawing 363 x 440

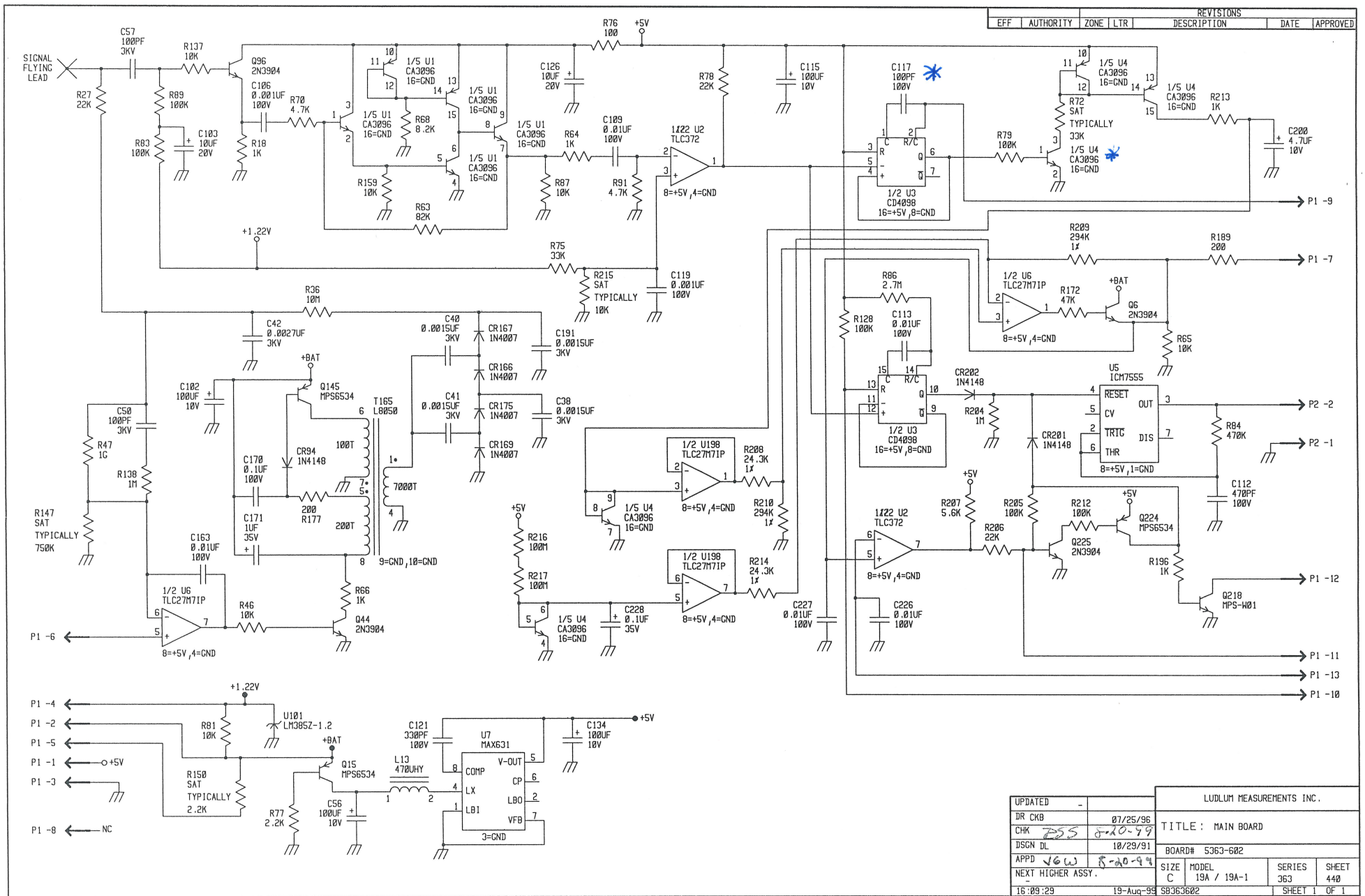
*Main Board Component Layout, Drawing 363 x 441

Calibration Board, Drawing 367 x 48

Calibration Board Component Layout, Drawing 367 x 150

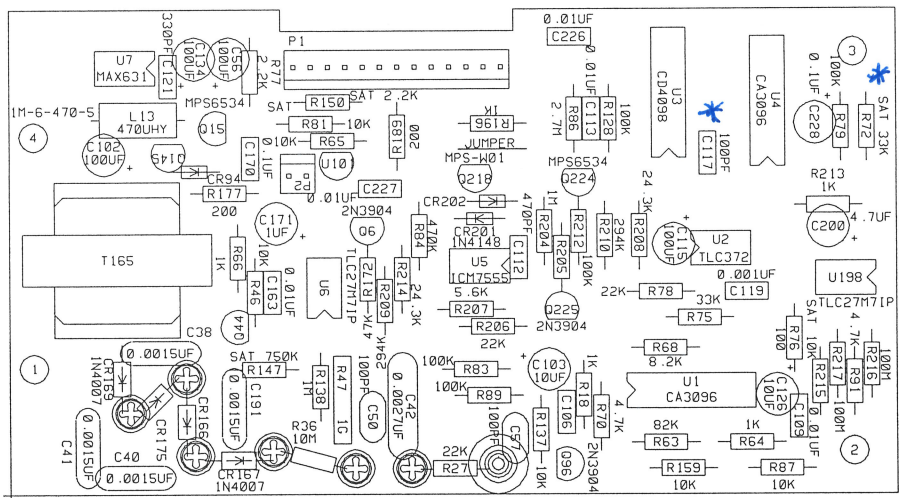
Wiring Diagram, Drawing 367 x 47

*** Handwritten changes were made on these drawings for the μSv version of this instrument.**



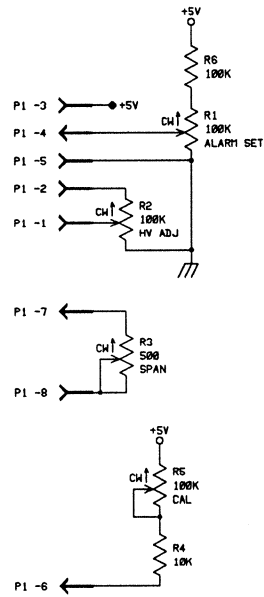
* for psu/h version:
 C117 = 33PF
 R72 = 82KΩ

UPDATED					LUDLUM MEASUREMENTS INC.			
DR CKD	-	07/25/96	TITLE: MAIN BOARD					
CHK	BSS	8-20-99	BOARD# 5363-602		SIZE	MODEL	SERIES	SHEET
DSGN DL	-	10/29/91			C	19A / 19A-1	363	440
APPD	JGW	8-20-99						
NEXT HIGHER ASSY.	-	-						
16:09:29	19-Aug-98	SB363602	SHEET 1 OF 1					

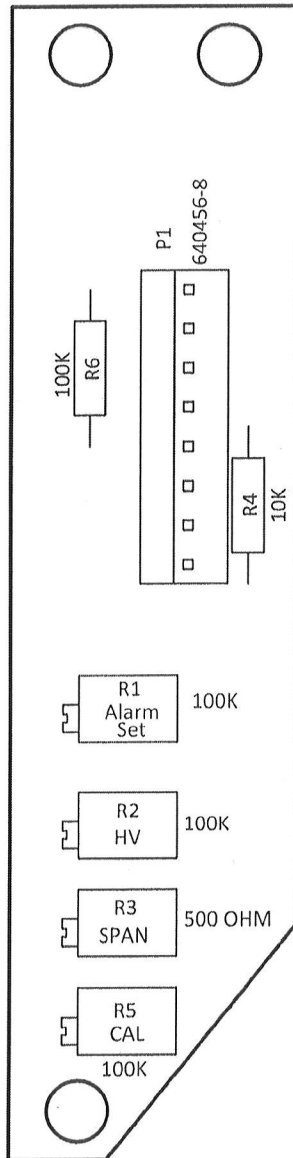


		LUDLUM MEASUREMENTS INC. SHEETWATER, TX.	
DR	CKB 07/25/96	TITLE : MAIN BOARD	
CHK	/ /	BOARD#	5363-602
DSCN	DL 10/29/91	MODEL	19A / 19A-1
APP	<i>RJB</i>	SERIES	363
12:22:00	5-Mar-13	SHEET	441
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SLDR PASTE	<input type="checkbox"/>	SLDR MASK	<input type="checkbox"/>


REVISIONS						
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED



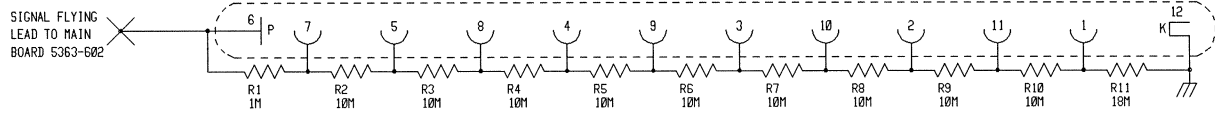
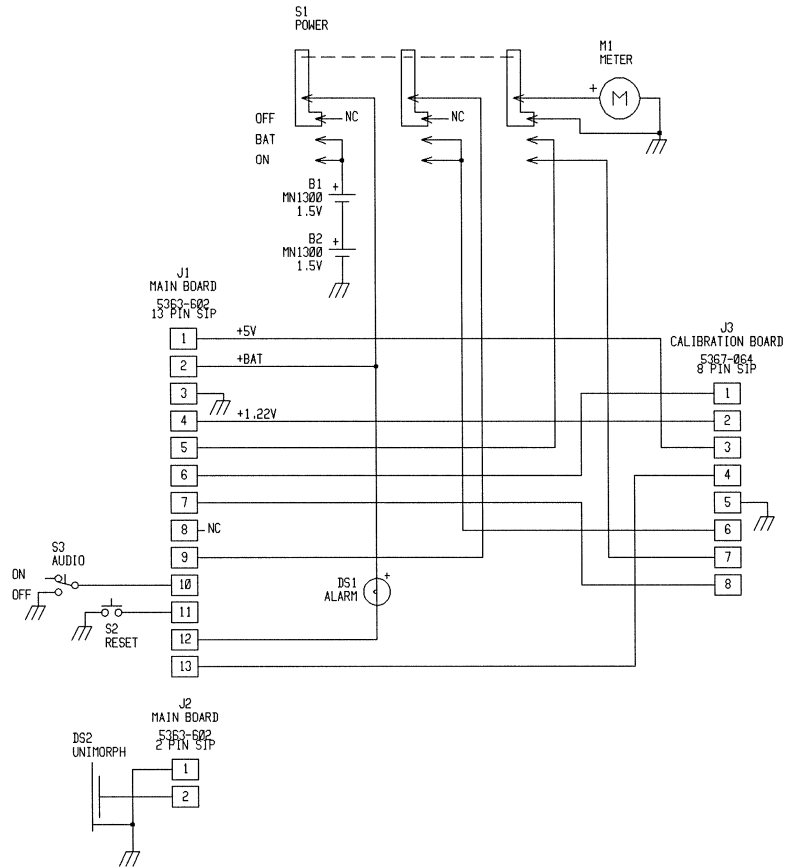
CONTRACT		LUDLUM MEASUREMENTS INC.			
-		501 OAK			
DR PH		SHEETHATER, TEXAS 79556			
CHK	R.C.	11/6/91	TITLE CALIBRATION BOARD		
ENG PH		11/6/91	5387-064		
APPD	835 7 11/8	SIZE	MODEL	DWG NO.	
NEXT HIGHER ASSY.		D	19A	- 367	48
15:44:40	7-Jan-92	S367064	SHEET 1 OF 1		



Scale 2:1

		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
Title: Calibration Board			
Drawn: CKB	09/08/2005	Model: 19A	
Design: PW	09/08/2005	Board#: 536-064	
Approve: <i>RB</i>	<i>11/15/2016</i>	Rev: 1	
Print Date: 11/15/2016 4:02:32 PM		SCALE: 1.00 Top Overlay	Series 367
		Sheet 150	
W:\Projects\LMM 19A\5367-064\Rev1\367064R1_Manual.PcbDoc			

				REVISIONS		
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED



LUDLUM MEASUREMENTS INC.			
UPDATED	-	DR CKB	02/06/92
CHK	RDS 10-12-00	TITLE:	WIRING DIAGRAM
DSCN	- XX-XXX-XX	BOARD#	367-063
APPD	RDS 130400	SIZE	MODEL
NEXT HIGHER ASSY.		C	19A
		SERIES	367
		SHEET	47
14:21:27	28-Jul-93	SB367063	SHEET 1 OF 1