Instruction Manual

LUDLUM MODEL 19 MICRO R METER

LUDLUM MEASUREMENTS, INC.

501 OAK 915 - 235-5494 P. O. BOX 810

SWEETWATER, TEXAS, U.S.A., 79556

DESIGNER AND MANUFACTURER

OF

Scientific and Industrial

INSTRUMENTS

WARRANTY CERTIFICATE

Ludlum Measurements, Inc. warrants the products covered in this Instruction Manual to be free of defects due to workmanship, materials, and design for a period of twelve months from the date of delivery.

In the event of instrument failure, notify Ludlum Measurements, Inc. for repair or replacement. Liability of this warranty is limited to the purchase price of the instrument.

RECEIVING CONDITION EXAMINATION

Be sure to verify that the shipping carton is received in perfectly good condition. For example, that no damage should be visible.

Should the instrument be received in a damaged condition, save the shipping container and the packing material and request an immediate inspection by the carrier.

Ludlum Measurements, Inc. is not responsible for the damage which occurs during shipment, but will make every effort to help obtain restitution from the carrier.

RETURN OF GOODS TO MANUFACTURER

If equipment needs to be returned to Ludlum Measurements, Inc. for repair, calibration, etc., please do so by the appropriate method of shipment. All shipments should include documentation containing shipping address, customer name and telephone number, and all other necessary information.

Your cooperation will expedite the return of your equipment.

LUDLUM MODEL 19 MICRO R METER

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MAY 1982

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1. GENERAL

The Ludlum Model 19 Micro R Meter utilizes an internally-mounted, 1" x 1" NaI(Tl) scintillator to offer an optimum performance in counting low-level gamma radiation. Designed to be moisture and dust resistant, conveniences are not overlooked as the unit features a pushbutton lighted meter.

Five range divisions are provided from which to select the most desirable range in the 0-5000 micro R/Hr spectrum. The meter face is made up of two scales, 0-50 and 0-25, plus battery test. The 0-50 scale corresponds to the 50, 500 and 5000 positions on the range selector switch. The 0-25 scale corresponds to the 25 and 250 positions on the range selector switch.

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

All controls, including a calibration potentiometer for each range, are located on the front panel. Two "D" cell batteries are located in an isolated compartment and easily changed from the front panel. The meter is housed in a rugged, two-piece aluminum bezel with waterproof seals.

2. SPECIFICATIONS

LINEARITY: plus or minus 5% of full scale

INPUT IMPEDANCE: 0.1 megohm

HIGH VOLTAGE: variable from 400 to 1500 volts DC, electronically regulated to within -1%

CALIBRATION STABILITY: less than 15% variance to battery end point

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

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

COUNTING RANGES: 2-scale meter face presenting 0-50 Micro R/Hr with full scale range positions of X5000, X500 and X50; and 0-25 Micro R/Hr with range selections of X250 and X25

METER: 50 micro-amp, 2 2/1-inch scale

DETECTOR: RCA 6199 coupled to a 1" x 1" NaI(Tl) crystal mounted inside the instrument housing

FINISH: instrument housing of drawn-and-cast aluminum fabrication with computer-beige, polyurethane enamel and silk-screened nomenclature; rubber-booted switches

SIZE: 6.4 inches x 3.5 inches x 7.0 inches (H x W x L exclusive of handle)

WEIGHT: 4.5 pounds

3. DESCRIPTION OF CONTROLS AND FUNCTIONS

Range Selector Switch is a 6-position switch marked OFF, 5000, 500, 250, 50 and 25. Moving the range selector switch to one of the range positions (5000, 500, 250, 50, 25) provides the operator with an overall range of 0-5000 Micro R/Hr. Note that the range positions 5000, 500 and 50 are screened in black and correspond to the meter scale, screened in black. The range positions 250 and 25 are screened in red and correspond to the meter scale, screened in red.

AUDIO 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.

Fast-Slow Toggle Switch provides meter response. Selecting the "F" position of the toggle switch provides 90% of full scale meter deflection in 3 seconds. In "S" position, 90% of full scale meter deflection takes 11 seconds. In "F" position, there is fast response and large meter deviation. "S" position should be used for slow response and damped, meter deviation.

BATTERY Pushbutton Switch, when depressed, indicates the battery charge status on the meter. The range selector switch must be out of the OFF position.

RES Button, when depressed, provides a rapid means to drive the meter to zero.

Light Pushbutton Switch, when depressed, lights the meter face. This switch is marked with an "L".

HV Adjustment provides a means to vary the high voltage from 400 to 1500 volts.

Range Calibration Adjustments are recessed potentimeters located on line with each multiplier position. These adjustment controls allow individual calibration for each range multiplier.

4. OPERATING PROCEDURES

The Model 19 is a simple instrument to operate. All controls and adjustments are located on the front panel along with the battery compartment. The 1" x 1" NaI(Tl) Scintillator is mounted internally, deleting external cords or cables.

4.1 Prior to Turn-on

a. Check the batteries -- type installed and condition.
b. Adjust the audio ON-OFF switch as desired.
c. Adjust the meter response switch as desired.

4.2 Turn-on

a. Range Selector Switch: Select the 0-5000 range.
b. BAT TEST Button: Depress. Check the BAT test on the appropriate scale. Replace the batteries if the meter pointer is below the battery CHK line.
c. Light Button: Depress. Check for light on the meter face.
d. Meter Response Switch: Check the response in the "F" and "S" positions.
e. Audio ON-OFF Switch: Check for audio indication.
f. Check the instrument for the proper scale indication with a known source. Check all the ranges for the appropriate scale indication.
g. Reset Button: Depress. Check to see that the meter pointer returns to the zero position.
h. The instrument is ready for monitoring.

5. CALIBRATION

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

5.1 Remove the instrument from its case.

5.2 With the instrument off, remove the HV jumper at the C19-R5 junction.

5.3 Connect a pulser to the C1-R5 junction.

a. Set the pulse height at 80 millivolts, negative.
b. Calibrate the scales as follows:

Scale	Reading	Pulses/Minute
25	20	3,200
50	40	6,400
250	200	32,000
500	400	64,000
5,000	4,000	640,000

5.4 Connect the jumper back to the C19-R5 junction.

5.5 Replace instrument can
Note: The detector is not light-tight outside of the can.

5.6 Plateau instrument using Americium-241 using H.V. adjust potentionmeter on front panel.

5.7 Determine the plateau center voltage

a. Remove can
b. Measure H.V. at the detector plug on circuit board.

NOTE: The voltmeter must have a 20,000 ohm/volt, or greater input impedance.

5.8 Replace instrument can.

5.9 Take the Model 19 to a certified calibration range. Calibrate each scale for best fit at 1/5 and 4/5 scale. If the reading error exceeds 10% of reading, record the field versus the meter reading at 5 points on the scale. Place a copy of this meter correction on the instrument case.

5.10 If the calibration range background is too high for the Micro R scales, calibrate the 5000 scale as in Step 5.9.

a. Turn instrument off and remove instrument from can.
b. Remove H.V. Jumper
c. Turn instrument on
d. Connect pulser and determine pulse rate verses micro R/hr calibration point on 5000 scale.
e. Calibrate the lower scales with Pulser using information in step (c).

f. Turn instrument off and reconnect H.V. Jumper.
g. Replace can

5.11 Recheck all operating functions of the instrument prior to use.

6. MAINTENANCE

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 CAN OCCUR AT TEMPERATURES AS LOW AS 100° FAHRENHEIT. NEGLECTED BATTERY SEAL FAILURE WILL SURELY CAUSE ONE AWFUL MESS!

Instrument maintenance consists of keeping the instrument clean and periodically checking the batteries and calibration. Once initial calibration is performed, recalibration should not be required if the batteries are maintained in good condition.

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.

Under certain conditions, the NRC requires instrument recalibration every three months. Check the appropriate regulations to determine the recalibration schedule.

Also at three month intervals, the batteries should be removed and the battery contacts cleaned of any corrosion. 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.

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BILL OF MATERIALS

CHASSIS WIRING, DRAWING NO. 120 X 5

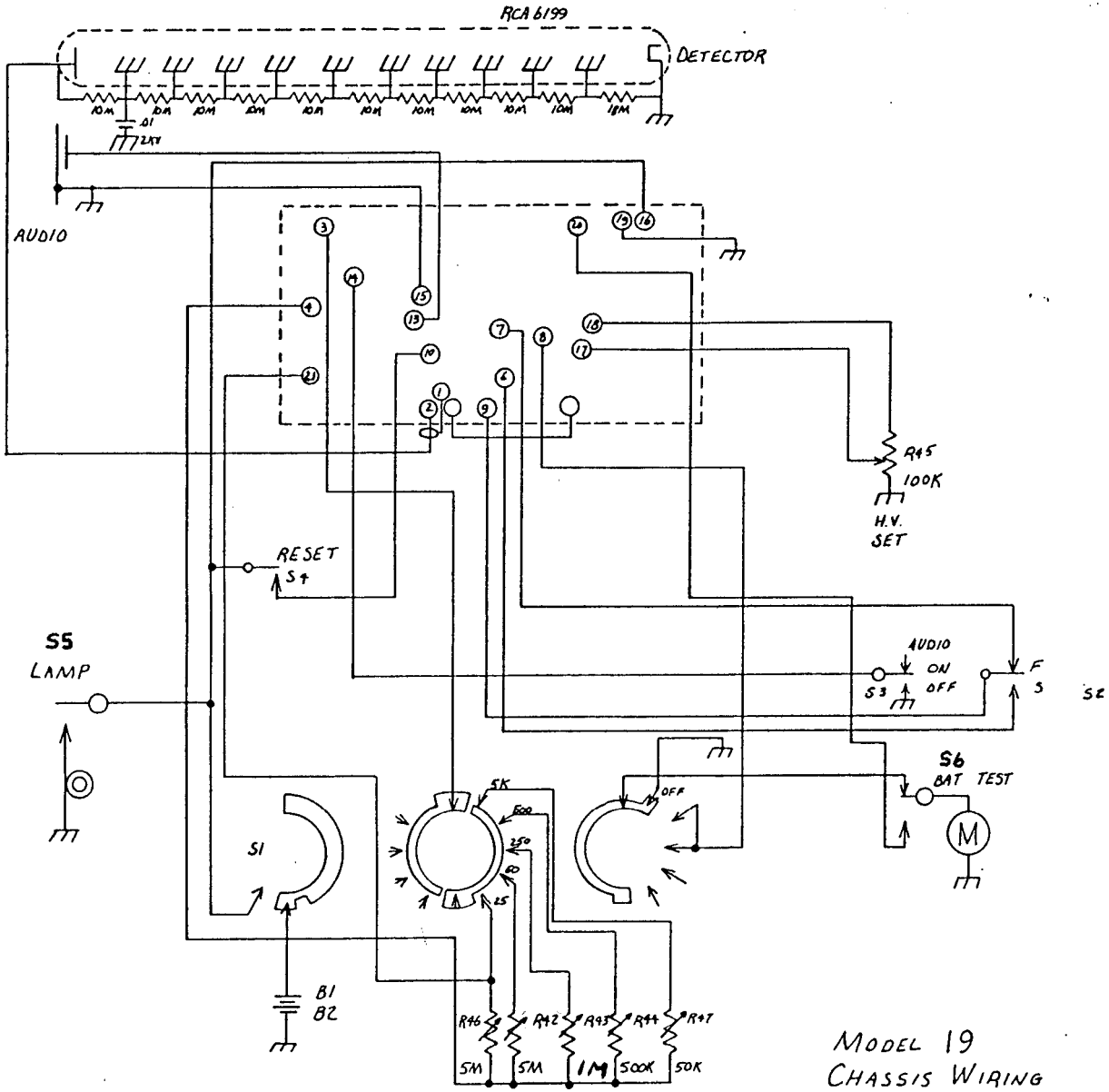
RESISTORS

R42	5 MEG WA2LO40S - 505MC	09-6783
R43	1 MEG WA2L040S - 105MC	09-6784
R44	500K WA2L040S - 504UC	09-6782
R45	100K WA2L040S - 104UC	09-6785
R46	5 MEG WA2L040S - 505MC	09-6783
R47	50K LOCK-W-503UC	09-6773

MISCELLANEOUS

S1	PA600-210	08-6501
S2	ALCO MST 105-D	08-6511
S3	ALCO MST 105-D	08-6511
S4	GRAYHILL 30-1 P/B	08-6517
S5	GRAYHILL 30-1 P/B	08-6517
S6	923 P/B	08-6518
DETECTOR	RCA6199	01-5001
PORTABLE METER		40-1805
AUDIO	UNIMORPH PN60690	21-9251

RCA 6199



MODEL 19
CHASSIS WIRING

SCALE	DWN BY CC	DATE 10-24-78
LUDLUM MEASUREMENTS INC SWEETWATER TEXAS	DWG NO 120 x 5	

LUDLUM MODEL 19 MICRO R METER

BILL OF MATERIALS

CIRCUIT BOARD, DRAWING NO. 120 X 6

CAPACITORS

C1	100PF, 3KV, C	04-5532
C2	100PF, 3KV, C	04-5523
C3	470PF, 100V, C	04-5555
C4	100PF, 1KV, C	04-5527
C5	.01MF, 50V, C	04-5523
C6	22MF, 15V, OST	04-5579
C7-C8	100MF, 10V, OST	04-5576
C9	4.7MF, 10V, OST	04-5578
C10	.1MF, 10V, C	04-5521
C11	4.7MF, 10V, OST	04-5578
C12	22MF, 15V, OST	04-5579
C13	100MF, 10V, DT	04-5576
C14	100MF, 10V, DT	04-5576
C15	100MF, 10V, OST	04-5576
C16	1MF, 35V, OST	04-5575
C17	.1MF, 10V, C	04-5521
C18	100PF, 3KV, C	04-5532
C19	.005MF, 2KV, C	04-5520
C20	.001MF, 3KV, C	04-5518
C21-C23	.001MF, 1KV, C	04-5519
C24	.01MF, 50V, C	04-5523
C25	470PF, 100V, C	04-5555

TRANSISTORS

Q4	MPS6534	05-5763
Q5-Q6	2N3877	05-5758
Q7	MPS6534	05-5763

INTEGRATED CIRCUITS

U1	CA3096	06-6023
U2	CD4093	06-6030
U3	CD4098	06-6066
U4	CA3096	06-6023
U5-U6	LM358	06-6024

DIODES

CR1	1N34A	07-6253

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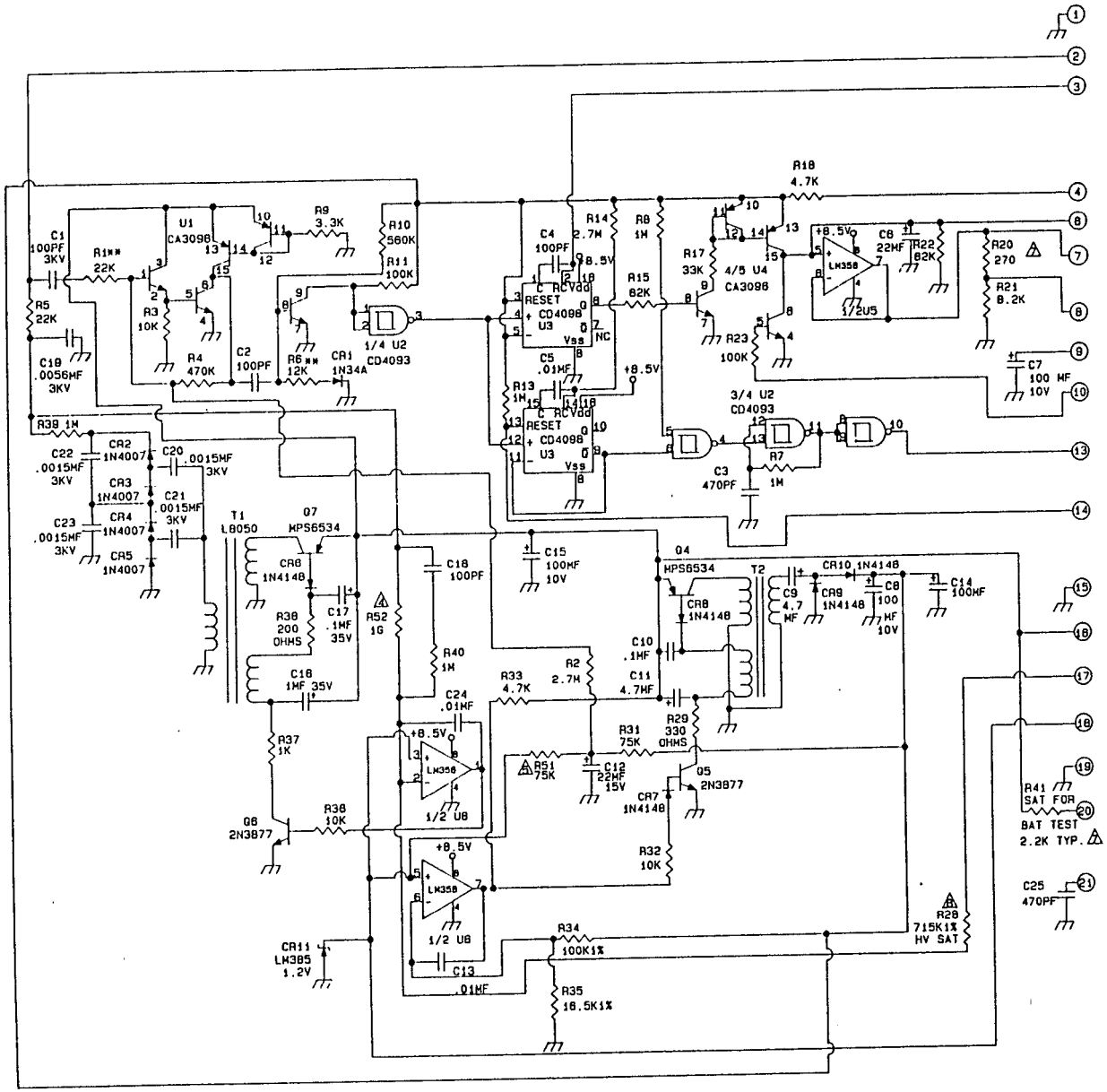
CR2-CR5	1N4007	07-6274
CR6-CR10	1N4148	07-6272
CR11	LM385Z-1.2	05-5808

RESISTORS

R1	22K	10-7070
R2	2.7 MEG	10-7029
R3	10K	10-7016
R4	470K	10-7026
R5	22K	10-7070
R6	12K	10-7048
R7	SAT @ 820K	10-7063
R8	1 MEG	10-7028
R9	3.3K	10-7013
R10	560K	10-7027
R11	100K	10-7023
R13	1 MEG	10-7028
R14	2.7 MEG	10-7029
R15	82K	10-7022
R17	22K	10-7070
R18	4.7K	10-7014
R20	22K	10-7070
R21	8.2K	10-7015
R22	82K	10-7022
R23	100K	10-7023
R28	715K 1%	12-7645
R29	330 OHM	10-7053
R31-R32	10K	10-7016
R33	15K	10-7017
R34	100K 1%	12-7557
R35	16.5K 1%	12-7541
R36	10K	10-7016
R37	1K	10-7009
R38	200 OHM	10-7006
R39	10 MEG	10-7031
R40	1 MEG	10-7028
R41	SAT @ 62K	10-7079
R51	75K	10-7074
R52	1G	12-7686

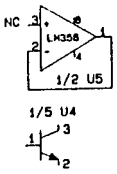
TRANSFORMERS

T1	L8050	40-0902
T2	LVPS	40-0944



NO.	DEVICE	POWER CONNECTIONS		
			+8.5V	GND
U1	CA3096			18
U2	CD4093		14	7
U3	CD4098		16	8
U4	CA3096			18
U5	LM358		8	4
U6	LM358		8	4

UNUSED CONNECTIONS



DESC: CIRCUIT BOARD SCHEMATIC	
MODEL: MODEL 19	
PART #: 5082-071-01	
DWN: HH	DATE: 10/28/88
DSGN:	DATE:

**FOR 10mV INPUT SENSITIVITY:
R1 = 10K
R8 = 24K

CHG#	ALTERATIONS	DATE	BY
1	R52 WAS RN1 500M	5/13/88	DTS
2	R51 ADDED	5/13/88	DTS
3	R28 WAS 374K 1%	5/13/88	DTS
4	R20 WAS 1.5K R41 WAS 82K FOR 50 MICRO-AMP METER (46588)	10/28/88	RHH

CHG	NO.				DWN	CHK	APP
DWN	DATE	CHK	DATE	APP	DATE		
HH	11/05/86		11/6/86				
TOL: SHOP STD ☐ OTHER			SCALE: FULL ☐ OTHER				
TITLE M19 MICRO A METER							
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556			SERIES 120		SHEET 6C		