

**LUDLUM MODEL 12S  
MICRO R METER**

**Revised July 2016  
Serial No. 176113 and Succeeding  
Serial Numbers**

**LUDLUM MODEL 12S  
MICRO R METER**

**Revised July 2016  
Serial No. 176113 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**

**Model 12S MICRO R METER**  
**July 2016**

**TABLE OF CONTENTS**

<b>1. GENERAL</b> .....	2
<b>2. SPECIFICATIONS</b> .....	2
<b>3. DESCRIPTION OF CONTROLS AND FUNCTIONS</b> .....	3
<b>4. OPERATING PROCEDURES</b> .....	3
<b>5. CALIBRATION</b> .....	4
<b>5.1 Equipment</b> .....	4
<b>5.2 Pulser Calibration</b> .....	4
<b>5.3 Plateau Procedure</b> .....	4
<b>5.4 Source Calibration</b> .....	4
<b>6. MAINTENANCE</b> .....	5
<b>7. THEORY OF OPERATION</b> .....	6
<b>7.1 Input</b> .....	6
<b>7.2 Amplifier</b> .....	6
<b>7.3 Discriminator</b> .....	6
<b>7.4 Audio</b> .....	6
<b>7.5 Digital Analog Convertor</b> .....	6
<b>7.6 Scale Ranging</b> .....	6
<b>7.7 Meter Drive</b> .....	6
<b>7.8 Meter Compensation</b> .....	6
<b>7.9 Fast/Slow Time Constant</b> .....	6
<b>7.10 Low Voltage Supply</b> .....	6
<b>7.11 Low Voltage Reference</b> .....	7
<b>7.12 High Voltage Supply</b> .....	7
<b>PARTS LIST</b> .....	8
<b>Model 12S Micro R Meter</b> .....	8
<b>Circuit Board, Drawing 363 X 488</b> .....	8
<b>Calibration Board, Drawing No. 363 X 490</b> .....	9
<b>Chassis Wiring Diagram, Drawing No. 464 X 57</b> .....	9
<b>DRAWINGS AND DIAGRAMS</b> .....	10

# Model 12S MICRO R METER

## July 2016

### 1. GENERAL

---

The Ludlum Model 12S Micro R Meter utilizes an internally mounted 2.5 x 2.5 cm (1 x 1 in.) NaI (TI) scintillator, which offers optimum performance in detecting low-level gamma radiation. The instrument is designed to be completely self contained and utilizes two "D" size batteries for power.

The instrument will respond to radiation from x-ray machines and pulsed radiation sources, but special techniques must be used to determine maximum time of instrument reading when it is exposed to this type of radiation.

This instrument is the choice for rapid surveys of very low-level radiation, as it is very sensitive to gamma energies. When it is exposed to predominantly low-energy gamma radiation, the reading will be high, but can be corrected by referring to energy independent instruments such as ion chambers.

Four range scales are provided to select the most desirable range in the 0 to 3000 mR/hr (Micro R/hr) spectrum. The meterface has one scale, 0-3 Micro R/hr with x1, x10, x100, and x1000 range multipliers.

The instrument is capable of using either standard alkaline batteries or nickel-cadmium rechargeable batteries. However, the Model 12S does not include circuitry for recharging batteries. The BAT test scale is provided to check the status of the batteries when the range selector switch is moved from the OFF position to the BAT position.

All controls, including a calibration potentiometer for each range, are located on the front panel. The two "D" cell batteries are located in an isolated compartment, accessible from the front panel. The meter is housed in a rugged, aluminum bezel with a gasket seal.

### 2. SPECIFICATIONS

---

**POWER:** two standard "D" size batteries

**RANGES:** four linear from 0 to 3000 mR/hr; meter scale presentation with range multiples of x1, x10, x100, and x1000

**INPUT SENSITIVITY:** adjustable 30-100 mV

**HIGH VOLTAGE:** externally adjustable from 400 to 1500 volts

**LINEARITY:** within 10% of true reading

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

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

**RESPONSE:** 4 seconds in fast (F) switch

position to 22 seconds in the slow (S) switch position for 90% of final meter reading

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

**BATTERY DEPENDANCE:** less than 15% variance to battery endpoint

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

**SIZE:** 22.2 x 21.6 x 8.6 cm (8.8 x 8.5 x 3.4 in.) (H x W x L), exclusive of handle

**WEIGHT:** 2.1 kg (4.6 lb) without detector and batteries

**FINISH:** drawn-and-cast aluminum with beige powder coat

**Model 12S MICRO R METER**  
**July 2016**

**3. DESCRIPTION OF CONTROLS AND FUNCTIONS**

---

**Range Multiplier Selector Switch:** A six-position switch marked OFF, BAT, x1000, x100, x10, and x1. Turning the range selector switch from OFF to BAT 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 (x1, x10, x100, x1000) provides the operator with an overall range of 0-3000 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 will be. The audio should be turned OFF, when not required, in order 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 "F" position the meter response is fast and has a large deviation. In "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.

**HV Adjustment:** Provides a means to vary the HV (high voltage) from 400 to 1500 volts. The HV 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 1/4 turn. To close, twist clockwise 1/4 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:** 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 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. Position the F-S toggle switch for the desired meter response.

Depress the RES switch. The meter should zero.

Proceed to use the instrument.

**Model 12S MICRO R METER**  
**July 2016**

**5. CALIBRATION**

---

**5.1 Equipment**

---

Calibrating the Model 12S requires some knowledge of pulser test equipment equivalent to the Ludlum Model 500 Pulser. The container must be removed from the rest of the instrument before calibrating. Unsnap the two latches and lift the front panel with the rest of the instrument out of the container. Turn the HV (high voltage) fully counterclockwise (minimum high voltage). Connect pulser to coaxial connection on the board in parallel with the detector. The input pulse to the Model 12S from the pulser should be a negative 40 millivolt pulse.

**NOTE:** Measure HV 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.

The pulse should be 5 micro-seconds in duration. It should have a 1 micro-second or less rise time and a tail of 10 to 20 micro-seconds. Set the GAIN for 40 millivolt sensitivity.

**5.2 Pulser Calibration**

---

The instrument is first calibrated in cpm (counts per minute) on the x1000 scale range. Provide 360,000 cpm from the pulser with an 80 millivolt pulse and calibrate the meter to read 2 mR/hr (Micro R/hr) on the meter scale. Decrease the counts by a factor of 10, and calibrate the x100 scale range for 2 mR/hr on the meter scale. Do the same for the x10 and x1 ranges.

**5.3 Plateau Procedure**

---

With the detector shielded from any sources, turn up the HV control in relatively large increments (50 volts at a time) and take a plot of HV versus count rate until the detector

voltage rating (or obvious breakdown) is reached. (Replace the instrument can after each HV adjustment).

With the detector exposed to an <sup>241</sup>Am check source, repeat the above procedure.

Plot both sets of data and select the operating voltage to correspond with maximum source count and minimum background count. Avoid areas of very rapid count rate changes with small changes in detector voltage.

**5.4 Source Calibration**

---

The instrument is then calibrated on a Cesium calibration range at the 2 mR/hr point, using the x1000 scale. Adjust the range calibration pot as necessary to read true 2000 mR/hr on the meter scale. Repeat for each scale at 200, 20 and 2 mR/hr. If an mR/hr range is not available, calibrate at 2000 mR/hr on a range. Remove the instrument from the can. The HV wire is removed and a pulser is connected. Determine the cpm required for a 2000 mR/hr meter deflection. Then, using the decade switch, decrease cpm and calibrate x100, x 10 and x1 ranges. Reconnect the HV wire and place the instrument back in the can.

**Example of HV versus Count Rate:**

<u>HV</u>	<u>BACKGROUND</u>	<u><sup>241</sup>Am</u>
500 V	5.5	5.5
550 V	15.0	150.0
600 V	16.0	550.0
650 V	16.0	700.0
700 V	16.0	700.0
750 V	18.0	700.0
800 V	27.0	700.0

The HV would be set at 700 volts for this particular set of data.

**Model 12S MICRO R METER**  
**July 2016**

**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 regulatory agencies' 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.

**CAUTION!**

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 37 °C (100 °F).

**CAUTION!**

Verify instrument voltage input rating before connecting to a power converter. If the wrong power converter is used, the instrument and/or power converter could be damaged.



## **7. THEORY OF OPERATION**

### **7.1 Input**

Detector pulses are coupled from the detector through C57 to emitter follower Q96. R83 and R89 provide bias. R137 protects Q96 from input shorts. R27 couples the detector to the HV supply.

### **7.2 Amplifier**

A self-biased amplifier provides gain in proportion to R63 divided by R70. Transistor (pin 6 of U1) provides amplification. Pin 12 and 15 of U1 are coupled as current mirror to provide a load for pin 6 of U1. The output self-biases to 2 Vbe (approximately 1.4 volts) at pin 7 of U1. This provides just enough bias current through pin 6 of U1 to conduct all of the current from the current mirror. Positive pulses from pin 7 of U1 are coupled to the discriminator.

### **7.3 Discriminator**

Comparator U2 provides discrimination. The discriminator is set by the voltage at pin 3 of U2. These pulses are coupled to pin 5 of U3 for meter drive and pin 12 of U3 for audio.

### **7.4 Audio**

Discriminator pulses are coupled to univibrator pin 12 of U3. Front-panel audio ON-OFF selector controls the reset at pin 13 of U4. When ON, pulses from pin 10 of U3 turn on oscillator U5, which drives the can-mounted unimorph. Speaker tone is set by R84 and C112; duration by R86.

### **7.5 Digital Analog Convertor**

Pins 12 and 15 of U4 are coupled as a current mirror. For each pulse of current through R72, an equal current is delivered to C105. This charge is drained off by R74. The voltage

across C105 is proportional to the incoming count rate.

### **7.6 Scale Ranging**

Detector pulses from the discriminator are coupled to univibrator pin 5 of U3. For each scale, the pulse width of pin 6 of U3 is increased 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 C105 by one count on the x1 range and 1000 counts on x1000 range.

### **7.7 Meter Drive**

The meter is driven by the emitter to Q6, coupled as a voltage follower in conjunction with pin 1 of U6. For ratemeter drive, the meter is coupled to C105 at P1-15. For battery test, the voltage follower is bypassed, and the meter movement is directly coupled to the battery through R150.

### **7.8 Meter Compensation**

When the unit is provided with a high-torque meter movement, with a 1.2 volt drive, a temperature compensation circuit is provided on the main circuit board; components R181, R189, and R190.

### **7.9 Fast/Slow Time Constant**

For slow time constant, C104 is switched from the output of the meter drive to parallel C105.

### **7.10 Low Voltage Supply**

Battery voltage is coupled to U7 and associated components (a switching regulator) to provide 5 volts at pin 5 to power all logic circuits. Unregulated battery voltage is used to power the meter drive (Q6) and the HV blocking

oscillator (Q145).

### **7.11 Low Voltage Reference**

U101 provides a 1.22 volt precision reference for HV supply. This unit also biases Q96.

### **7.12 High Voltage Supply**

HV is developed by blocking oscillator Q145-T165 and rectified by voltage multiplier CR166, 167, 169, and 175. Output voltage increases as current through Q44 increases, with maximum output voltage with Q44 saturated.

HV is coupled back through R47 to opamp pin 6 of U6. R147 completes the high-voltage circuit-to-ground. HV output is set by front-panel control HV, which sets bias of pin 5 of U6. During stable operation, the voltage at pin 6 of U6 will equal the voltage at pin 5 of U6. Pin 7 of U6 will cause conduction of Q44 to increase or decrease until the HV seeks a level of stability.

**Model 12S MICRO R METER**  
**July 2016**

**PARTS LIST**

Ref. No.	Description	Part No.	U4 Ref. No.	CA3096 Description	06-6023 Part No.
<b>Model 12S Micro R Meter</b>					
UNIT	Completely Assembled Model 12S Micro R Meter	48-1610	U5	ICM7555	06-6136
			U6	TLC27M7IP	06-6248
			U7	MAX631	06-6249
			U101	LM385Z-1.2	05-5808
<b>Circuit Board, Drawing 363 X 488</b>					
BOARD	Assembled Circuit Board	5363-641	<b>DIODES</b>		
			CR94	1N4148	07-6272
			CR166-CR167	1N4007	07-6274
			CR169	1N4007	07-6274
			CR175	1N4007	07-6274
<b>CAPACITORS</b>					
C38	0.0015μF, 3kV, C	04-5518			
C40-C41	0.0015μF, 3kV, C	04-5518	<b>RESISTORS</b>		
C42	0.0027μF, 3kV, C	04-5520	R18	1k	10-7009
C50	100pF, 3kV, C	04-5532	R27	22k	10-7070
C56	100μF, 10V, DT	04-5576	R36	10M	10-7031
C57	100pF, 3kV, C	04-5532	R46	10k	10-7016
C102	100μF, 10V, DT	04-5576	R47	1G	12-7686
C103	10μF, 20V, DT	04-5592	R63	82k	10-7022
C104	47μF, 16V, DT	04-5550	R64	1k	10-7009
C105	10μF, 20V, DT	04-5592	R65	10k	10-7016
C106	0.001μF, 100V, C	04-5519	R66	1k	10-7009
C109	0.01μF, 100V, C	04-5523	R68	8.2k	10-7015
C112	470pF, 100V, C	04-5555	R70	4.7k	10-7014
C113	0.01μF, 100V, C	04-5523	R72	SAT (TYP. 33k)	10-7019
C115	100μF, 10V, DT	04-5576	R74	180k	10-7068
C117	100pF, 100V, C	04-5527	R75	33k	10-7019
C119	0.001μF, 100V, C	04-5519	R76	100 OHM	10-7004
C121	330pF, 100V, C	04-5531	R77	2.2k	10-7012
C126	10μF, 20V, DT	04-5592	R78	22k	10-7070
C134	100μF, 10V, DT	04-5576	R79	100k	10-7023
C163	0.01μF, 100V, C	04-5523	R81	10k	10-7016
C170	0.1μF, 100V, C	04-5521	R83	100k	10-7023
C171	1μF, 35V, DT	04-5575	R84	470K	10-7026
C191	0.0015μF, 3kV, C	04-5518	R86	2.7M	10-7029
<b>TRANSISTORS</b>					
Q6	2N3904	05-5755	R87	10k	10-7016
Q15	MPS6534	05-5763	R89	100k	10-7023
Q44	2N3904	05-5755	R91	4.7k	10-7014
Q96	2N3904	05-5755	R128	100k	10-7023
Q145	MPS6534	05-5763	R137	10k	10-7016
<b>INTEGRATED CIRCUITS</b>					
U1	CA3096	06-6023	R138	1M	10-7028
U2	TLC372	06-6265	R147	SAT (TYP. 715k, 1%)	12-7645
U3	CD4098	06-6066	R150	SAT (TYP. 2.37k, 1%)	12-7648
			R159	10k	10-7016
			R172	47k	10-7020
			R177	200 OHM	10-7006
			R189	301 OHM	12-7855
<b>THERMISTORS</b>					

**Model 12S MICRO R METER**  
**July 2016**

<b>Ref. No.</b>	<b>Description</b>	<b>Part No.</b>	<b>Ref. No.</b>	<b>Description</b>	<b>Part No.</b>
R181	R1006-98.4-59-D1	07-6332			
R190	R1006-98.4-59-D1	07-6332			
				<b>Chassis Wiring Diagram, Drawing No. 464 X 57</b>	
				<b>AUDIO</b>	
	<b>INDUCTORS</b>		DS1	UNIMORPH 60690	21-9251
L13	470 $\mu$ HY	21-9600			
				<b>CONNECTORS</b>	
	<b>TRANSFORMERS</b>		J1	1-640442-3 MTA 100	13-8138
T165	L8050	40-0902	J2	640442-2 MTA100	13-8178
			J3	640442-5 MTA100	13-8140
			J3	640442-4 MTA100	13-8170
	<b>CONNECTORS</b>				
P1	1-640456-3 MTA100	13-8100			
P2	640456-2 MTA100	13-8073			
				<b>SWITCHES</b>	
	<b>MISCELLANEOUS</b>		S1	Centerlab PA600-210	08-6501
			S2-S3	7101-SYZ-QE	08-6511
			S4	30-1-PB GRAYHILL	08-6517
*	RECEPTACLE (6 ea)				
	Cloverleaf 011-6809	18-8771			
*	CONTACT	18-9124			
*	JACK-TEST 1123-09-0319	18-8806			
				<b>MISCELLANEOUS</b>	
			B1-B2	"D" Duracell Battery	21-9313
			V1	M12S DETECTOR	47-1574
				X-TAL/TUBE ASSEMBLY	01-5786,
					4002-572 and 40-5154
	<b>Calibration Board, Drawing No. 363 X 490</b>				
BOARD	Completely Assembled		*	PORTABLE BATTERY NEGATIVE	
	Calibration Board	5363-642		CONTACT ASSEMBLY	2001-065
			*	PORTABLE BATTERY POSITIVE	
	<b>CAPACITORS</b>			CONTACT ASSEMBLY	2001-066
C1	0.047 $\mu$ F 100V C X7R	04-5565	*	CASTING	9363-481
C2	0.0047F 100V C X7R	04-5570	*	MAIN HARNESS	8363-645
			*	PORT. DEEP CAN ASSY	4363-615
			*	PORTABLE KNOB	08-6613
	<b>RESISTORS</b>		M1	PORT. BEZEL FRONT ASSY	4363-188
R1-R2	1 Meg Trimmer	09-6814	*	METER BEZEL W/GLASS,	
R3	100k Trimmer	09-6813		W/O SCREWS	4363-352
R4	1 Meg Trimmer	09-6814	*	METER MOVEMENT (1mA)	15-8030
R5	100k Trimmer	09-6813	*	PORTABLE METER FACE	7363-136
R7	100k Trimmer	09-6813	*	HARNESS- CAN (UNIMORPH)	8363-462
R8	10k, 1/3W, 5%	12-7748	*	BATTERY LID W/CE	9363-1008
			*	PORTABLE LATCH KIT	
				W/O BATT. LID	4363-349
	<b>RESISTOR NETWORKS</b>		*	PORT. CALIB. COVER	
				W/SCREWS	9363-200
RN1	NETWORK-10k SIP		*	PORT. HANDLE (ROLLED)	
	8PIN	12-7720		W/SCREWS	7363-139
			*	PORT HANDLE FOR CLIP	
	<b>CONNECTORS</b>			W/SCREWS	7363-203
P3	640456-5 MTA100	13-8057	*	REPLCMT CABLE (STD 39 in.)	40-1004
P4	640456-4 MTA100	13-8088	*	CLIP (44-3 TYPE) w/screws	7002-026-01
			*	CLIP (44-7 TYPE) w/screws	7010-007-01
			*	CLIP (44-6 TYPE) w/screws	7010-008-01

**Model 12S MICRO R METER**  
**July 2016**

**DRAWINGS AND DIAGRAMS**

---

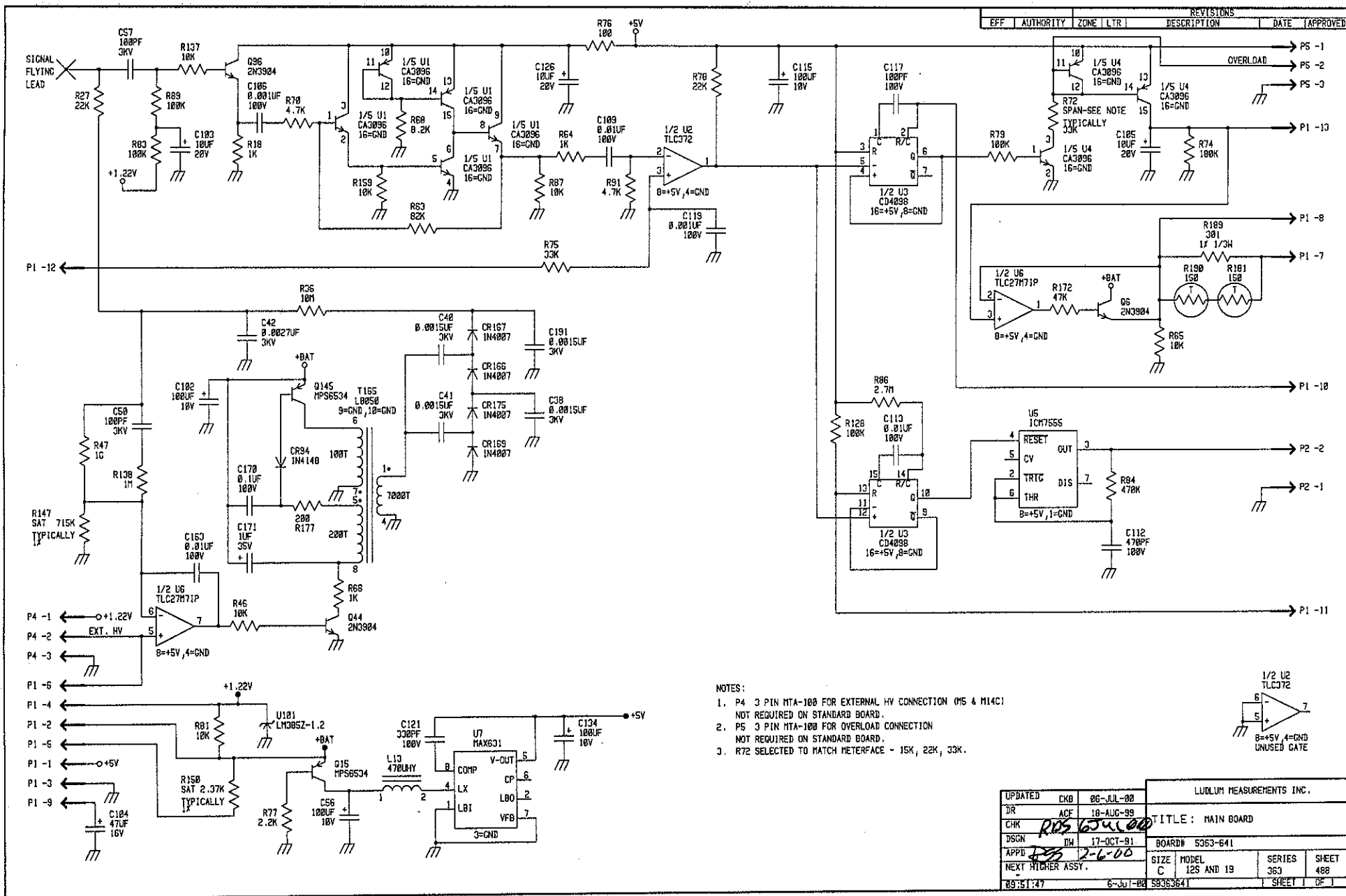
Main Circuit Board, Drawing 363 x 488

Main Circuit Board Component Layout, Drawing 363 x 489

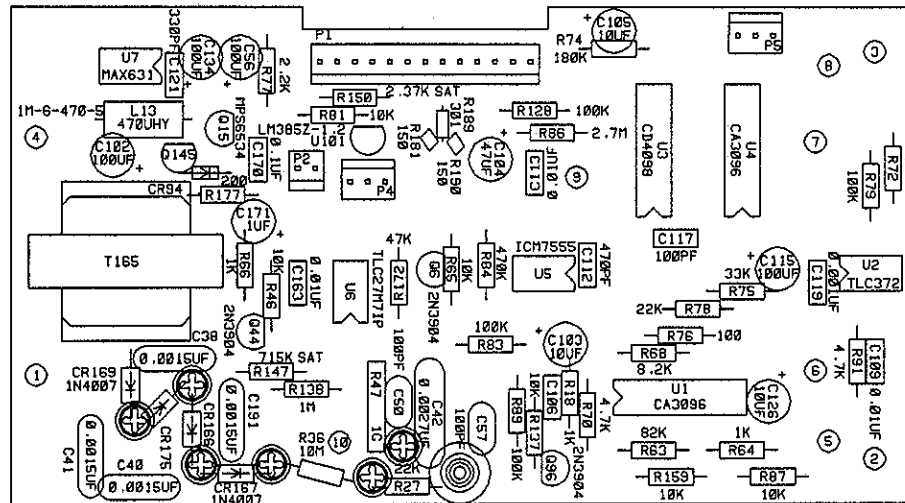
Calibration Board, Drawing 363 x 490

Calibration Board Component Layout, Drawing 363 x 491

Wiring Diagram, Drawing 464 x 57



- NOTES:
- P4 3 PIN MTA-100 FOR EXTERNAL HV CONNECTION (M5 & M14C)  
NOT REQUIRED ON STANDARD BOARD.
  - P5 3 PIN MTA-100 FOR OVERLOAD CONNECTION  
NOT REQUIRED ON STANDARD BOARD.
  - R72 SELECTED TO MATCH METERFACE - 15K, 22K, 33K.



BOARD

DIMENSIONS:

WIDTH = 5.147"

HEIGHT = 2.810"

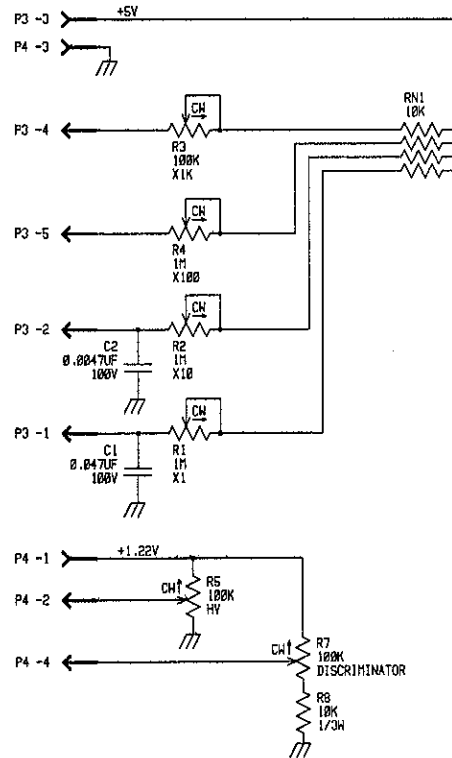
MOUNTING HOLE

LOCATIONS:

1. X=0.140"  
Y=0.734"
2. X=4.897"  
Y=0.250"
3. X=4.897"  
Y=2.560"
4. X=0.140"  
Y=2.076"

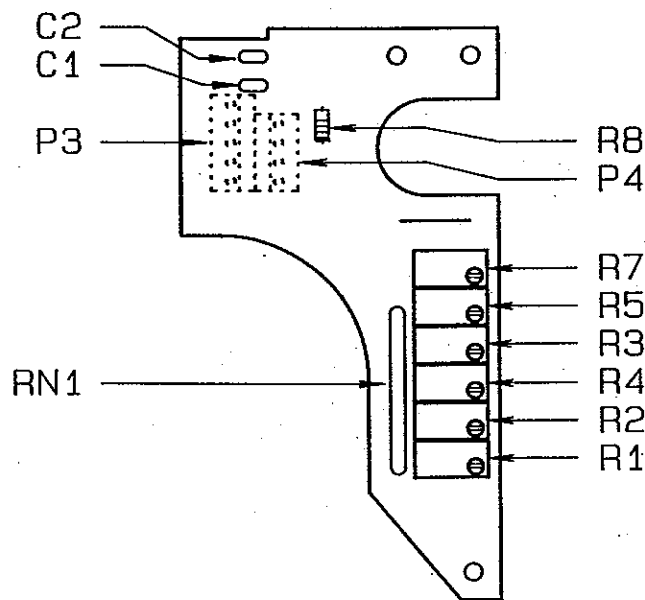
<input checked="" type="checkbox"/> LUDLUM MEASUREMENTS INC. SHEETWATER, TX.			
DR	CKB	06-JUL-00	TITLE: MAIN BOARD
CHK	RYS	6 JUL 00	BOARD: 5363-641
DSGN	DW	17-OCT-91	MODEL: 125 AND 19
APP	RYS	7-6-00	FILENAME: BS363641
COMPONENT	SOLDER	6-JUL-00	09:54:47
OUTLINE	OUTLINE	REVISION	SERIES SHEET
		1.0	363 489

REVISIONS			
EFF	AUTHORITY	ZONE	DATE



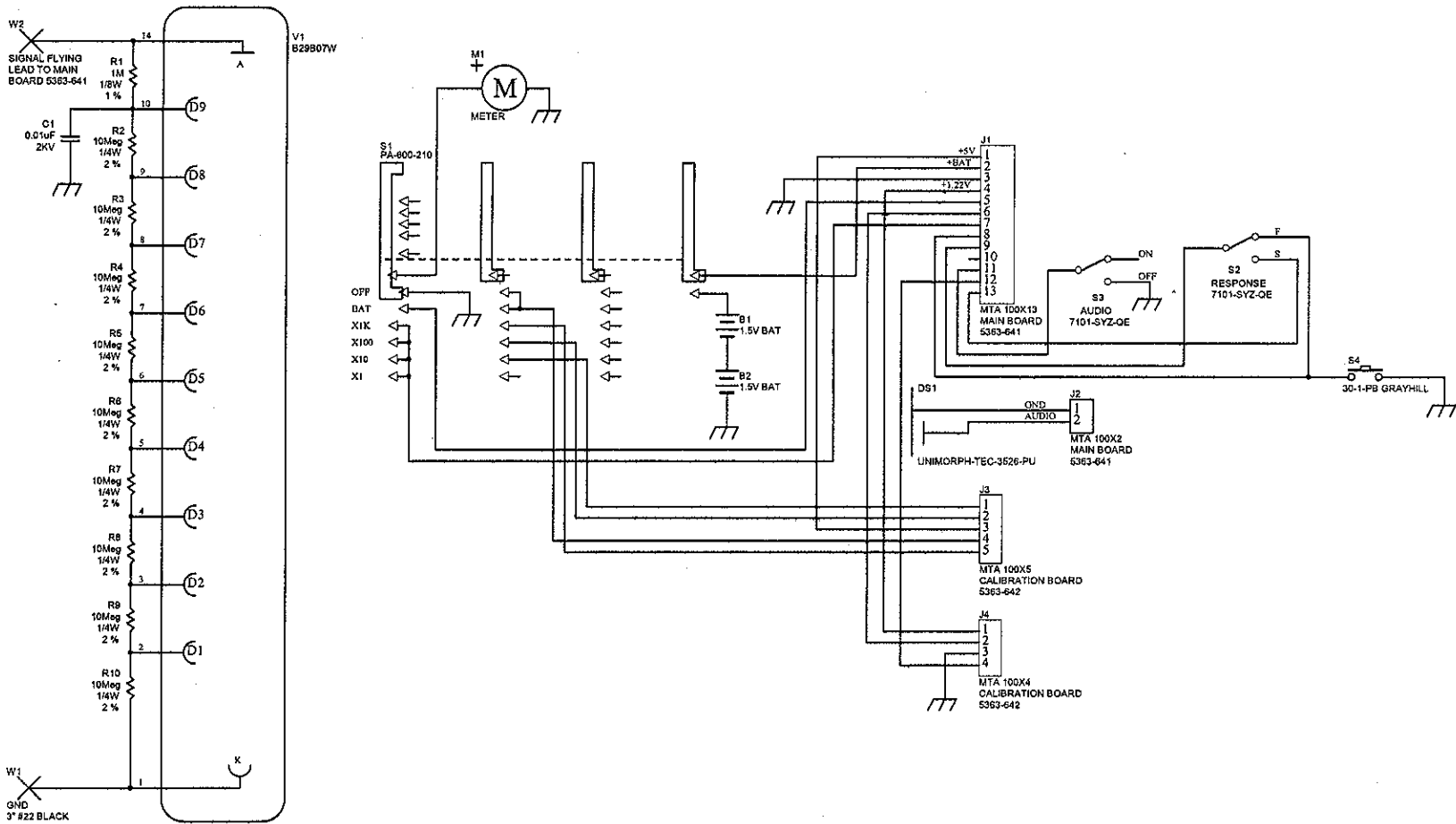
LUDLUM MEASUREMENTS INC.			
UPDATED	-	18-AUG-99	TITLE: CALIBRATION BOARD
DR ACF	-	8-18-99	BOARD# 5363-642
CHK	RSS	-	SIZE C
DSGN	-	-	MODEL 125
APPD	JOW	8-18-99	SERIES 363
NEXT HIGHER ASSY.	-	-	SHEET 458
14-58-128	18-Aug-99	58363642	SHEET 1 OF 1





DESC: COMPONENT OUTLINE	
MODEL: 12S	
PART #: 5363-642	
DWN: CKB	DATE: 03/25/92
DSGN:	DATE:

CHK NO.		DWN	CHK	APP
DWN	DATE	CHK	DATE	APP
CKB	03/25/92	JK	3-25-92	JK
TOL:	SHOP STD <input type="checkbox"/>	SCALE:	FULL <input type="checkbox"/>	OTHER <input type="checkbox"/>
TITLE MODEL 12S CALIBRATION BOARD				
LUOLUN MEASUREMENTS, INC.		SERIES	SHEET	
2101 W. STREET		383	491	
DREXTON, TEXAS 75008				



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

Drawn:	ACF	06-AUG-99	Title:	WIRING DIAGRAM
Design:			Model:	12S
Check:	<i>W</i>	<i>8-10-99</i>	Board#:	W464-057
Approve:	<i>R.C.</i>	<i>8-12-99</i>	Sheet:	1 of 1
16:05:14		10-Aug-1999	Rev:	1.0
X:\Projects\lmi\Portables\12S\Wiring Diagram\464X57.sch			Series	Sheet
			464	57