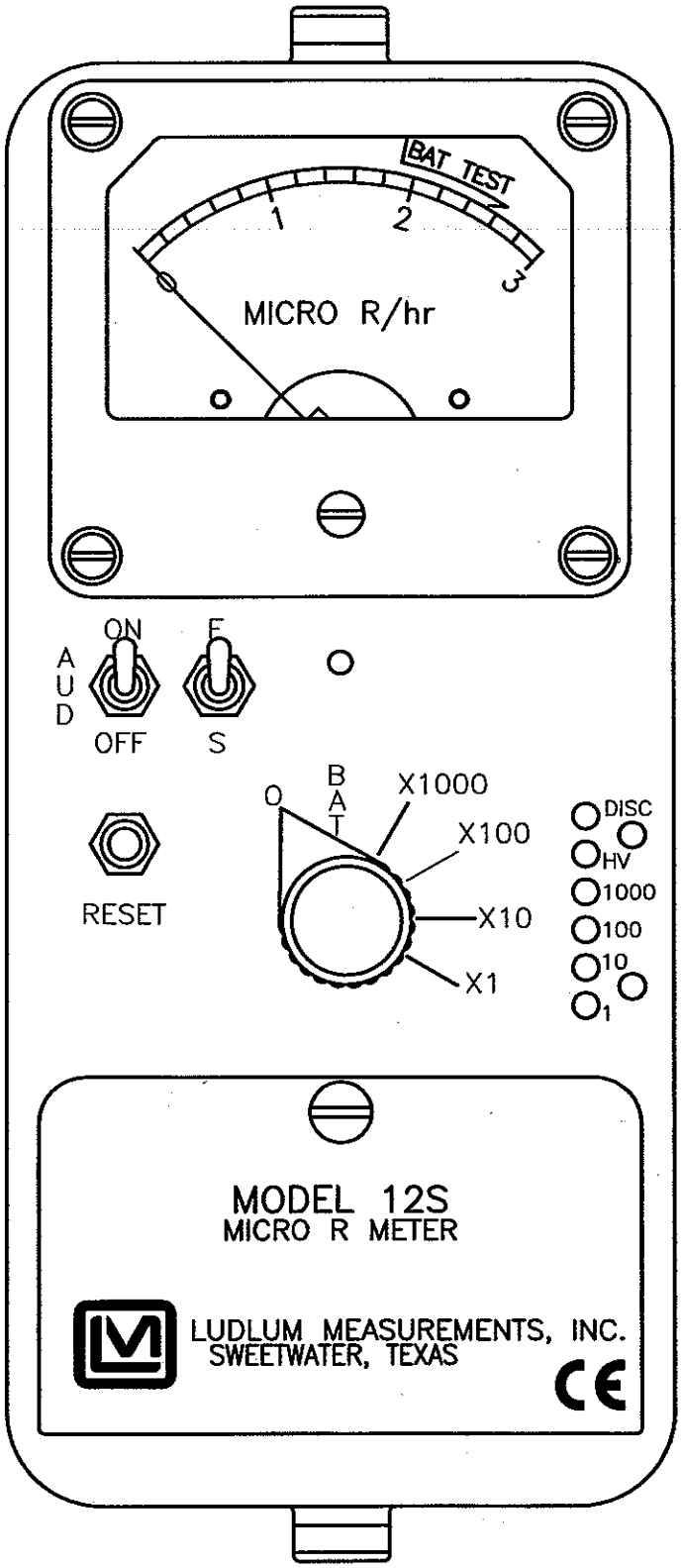
LUDLUM MODEL 12S
MICRO R METER

Revised April 2002
Serial No. 176113 and Succeeding
Serial Numbers

LUDLUM MEASUREMENTS, INC.
501 OAK ST., P.O. BOX 810
SWEETWATER, TX 79556
915/235-5494 FAX: 915/235-4672

REV #	ALTERATIONS	DATE	BY
1	VALID	05-21-01	TJR



DWN	DATE	CHECKED	APPROVED
TJR	05-21-01	JGW 5-21-01	LLL 5-23-01

TITLE: M 12S MICRO R METER

LUDLUM MEASUREMENTS, INC.
501 OAK STREET
SWEETWATER, TEXAS 79556

SERIES 363

SHEET 252

M12S MICRO R METER
April 2002

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1. GENERAL

The Ludlum Model 12S Micro R Meter utilizes an internally mounted 1" x 1" NaI(Tl) 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 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 carbon-zinc 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 micro R/hr; meter scale presentation with range multiples of X1, X10, Xl00, X1000
- **INPUT SENSITIVITY**: Adjustable from 30-100 mV
- **HIGH VOLTAGE**: externally adjustable from 400 to 1500 volts
- **LINEARITY**: plus or minus 10% of true reading
- **METER**: 1mA, 2 1/2-inch scale, with pivot-and-jewel suspension
- **METER COMPENSATION**: temperature compensation is provided by the thermistors on the main circuit board
- **RESPONSE**: Four or twenty-two seconds 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**: 15.75cm (6.2")H X 8.9cm (3.5")W X 21.6cm (8.5")L, exclusive of handle
- **WEIGHT**: 1.8kg (4 lbs.), without 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, 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 micro R/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, 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 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.

- **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 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.

5. CALIBRATION

5.1 Equipment

Calibrating the Model 12S requires some knowledge of pulser test equipment. 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 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 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.

The pulse should be 5 micro-seconds in duration. It should have a 1 micro-second rise time or less 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 counts per minute (CPM) on the X1000 scale range. Provide 360,000 CPM from the pulser with an 80 millivolt pulse and calibrate the meter to read 2 Micro R/hr on the meter scale. Decrease the counts by a factor of 10 and calibrate the X100 scale range for 2 Micro R/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 high voltage 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 Am^{241} 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 Micro R/hr on the meter scale. Repeat for each scale at 200, 20 and 2 Micro R/hr. If a Micro R/hr range is not available, calibrate at 2000 Micro R/hr on a range. Remove the instrument from the can. The HV wire is removed and a pulser connected. Determine the CPM required for a 2000 Micro R/hr meter deflection. Then, using the decade
switch, decrease CPM and calibrate X100, X10 and X1 ranges. Reconnect the HV wire and place the instrument back in the can.

- **Example of HV versus Count Rate:**

HV	BACKGROUND	Am^{241}
500V	5.5	5.5
550V	15.0	150.0
600V	16.0	550.0
650V	16.0	700.0
700V	16.0	700.0
750V	18.0	700.0
800V	27.0	700.0

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

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.

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 100° FAHRENHEIT.

7. THEORY OF OPERATION

7.1 Input

Detector pulses are coupled from the detector through C57 to emitter follower Q96. R83, R89 provide bias. R137 protects Q96 from input shorts. R27 couples the detector to the high voltage 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 12,15 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 turns on oscillator U5, which drives the can mounted unimorph. Speaker tone is set by R84,C112; duration by R86.

7.5 Digital Analog Convertor

Pin 12,15 of U4 are coupled as a current mirror. For each pulse of current through R72, and 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 as 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 1.2 volt drive, a temperature compensation circuit is provided on the Main Circuit board; components R181,R189 & 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 high voltage 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

High voltage 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.

High voltage is coupled back through R47 to opamp pin 6 of U6. R147 completes the high voltage circuit to ground. High voltage 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 high voltage seeks a level of stability.

PARTS LIST

Ref. No.	Description	Part No.
	Model 12S Micro R Meter	
UNIT	Completely Assembled Model 12S Micro R Meter	48-1610
	Circuit Board, Drawing 363 X 488	
BOARD	Assembled Circuit Board	5363-641
•	**CAPACITORS**	
C38	0.0015µF, 3kV, C	04-5518
C40-C41	0.0015µF, 3kV, C	04-5518
C42	0.0027µF, 3kV, C	04-5520
C50	100pF, 3kV, C	04-5532
C56	100µF, 10V, DT	04-5576
C57	100pF, 3kV, C	04-5532
C102	100µF, 10V, DT	04-5576
C103	10µF, 20V, DT	04-5592
C104	47µF, 16V, DT	04-5550
C105	10µF, 20V, DT	04-5592
C106	0.001µF, 100V, C	04-5519
C109	0.01µF, 100V, C	04-5523
C112	470pF, 100V, C	04-5555
C113	0.01µF, 100V, C	04-5523
C115	100µF, 10V, DT	04-5576
C117	100pF, 100V, C	04-5527
C119	0.001µF, 100V, C	04-5519
C121	330pF, 100V, C	04-5531
C126	10µF, 20V, DT	04-5592
C134	100µF, 10V, DT	04-5576
C163	0.01µF, 100V, C	04-5523
C170	0.1µF, 100V, C	04-5521
C171	1µF, 35V, DT	04-5575
C191	0.0015µF, 3kV, C	04-5518
•	**TRANSISTORS**	
Q6	2N3904	05-5755
Q15	MPS6534	05-5763
Q44	2N3904	05-5755
Q96	2N3904	05-5755
Q145	MPS6534	05-5763
•	**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
•	**DIODES**	
CR94	1N4148	07-6272
CR166-CR167	1N4007	07-6274
CR169	1N4007	07-6274
CR175	1N4007	07-6274
•	**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 (TYP. 33k)	10-7019
R74	180k	10-7068
R75	33k	10-7019
R76	100 OHM	10-7004
R77	2.2k	10-7012
R78	22k	10-7070
R79	100k	10-7023
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 (TYP. 715k, 1%)	12-7645
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
•	**THERMISTORS**	
R181	R1006-98.4-59-D1	07-6332

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Ref. No.	Description	Part No.
R190	R1006-98.4-59-D1	07-6332
•	**INDUCTORS**	
L13	470μHY	21-9600
•	**TRANSFORMERS**	
T165	L8050	40-0902
•	**CONNECTORS**	
P1	1-640456-3 MTA100	13-8100
P2	640456-2 MTA100	13-8073
•	**MISCELLANEOUS**	
*	RECEPTACLE (6 ea) Cloverleaf 011-6809	18-8771
*	CONTACT	18-9124
*	JACK-TEST 1123-09-0319	18-8806

Calibration Board, Drawing No. 363 X 490

BOARD	Completely Assembled Calibration Board	5363-642
•	**CAPACITORS**	
C1	0.047μF 100V C X7R	04-5565
C2	0.0047μF 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
R8	10k, 1/3W, 5%	12-7748
•	**RESISTOR NETWORKS**	
RN1	NETWORK-10k SIP 8PIN	12-7720
•	**CONNECTORS**	
P3	640456-5 MTA100	13-8057
P4	640456-4 MTA100	13-8088

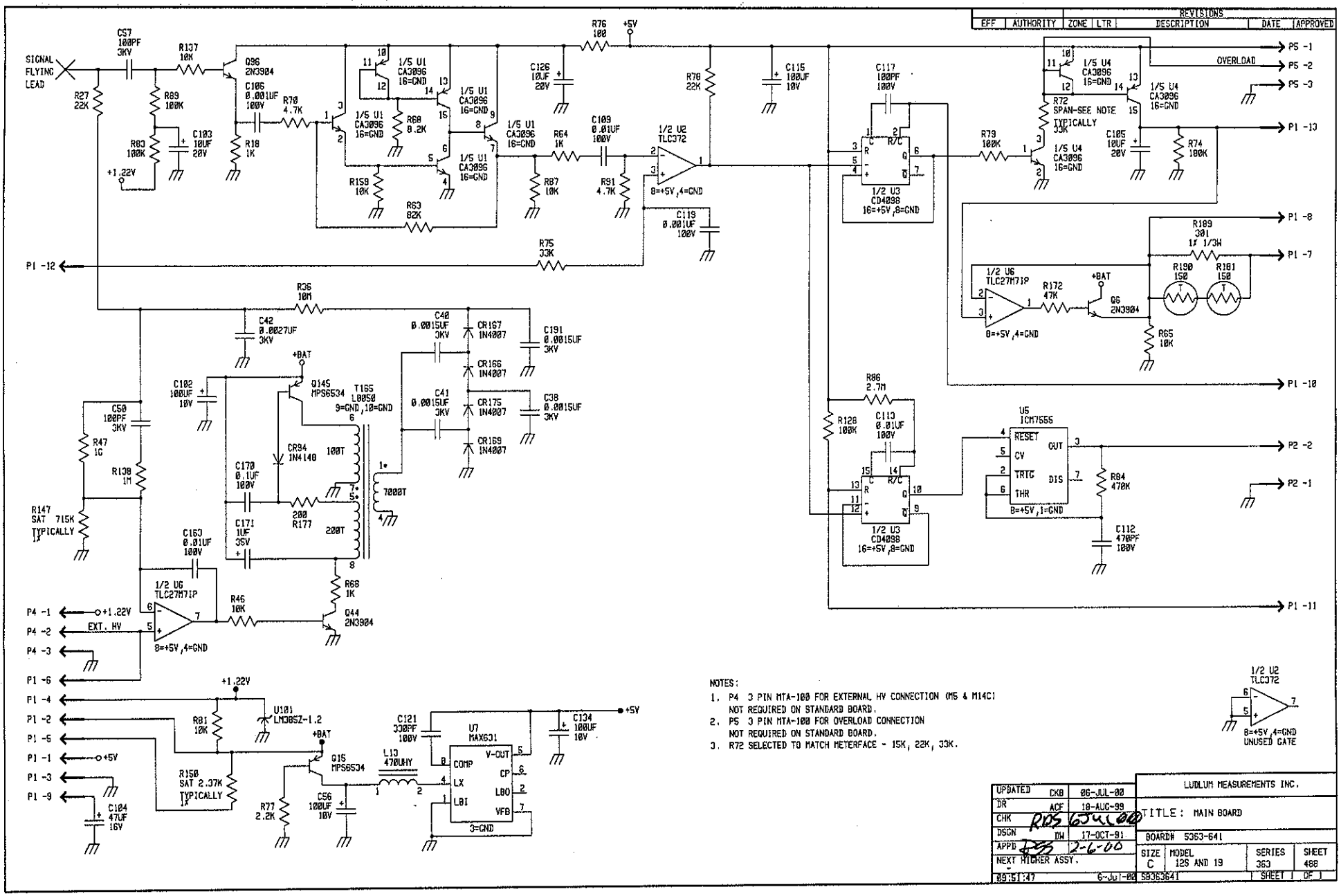
Ref. No.	Description	Part No.

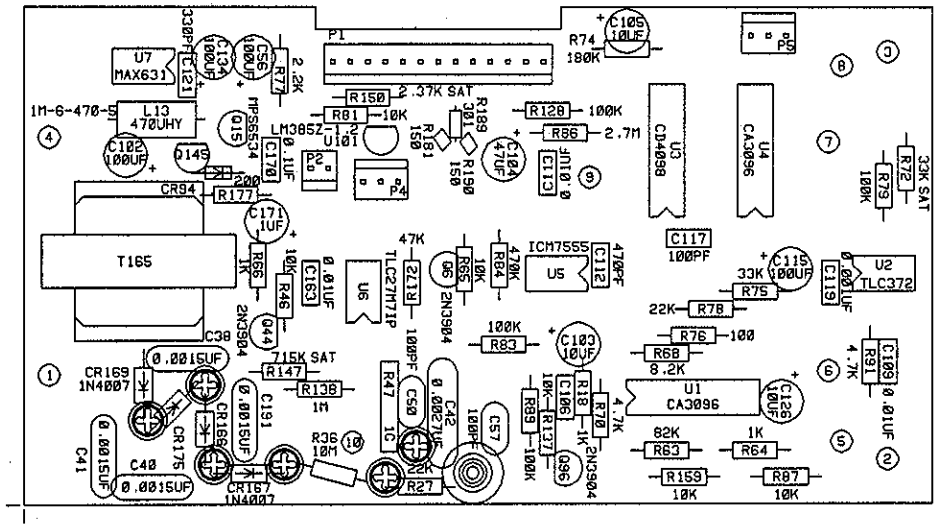
Chassis Wiring Diagram, Drawing No. 464 X 57

•	**AUDIO**	
DS1	UNIMORPH 60690	21-9251
•	**CONNECTORS**	
J1	1-640442-3 MTA 100	13-8138
J2	640442-2 MTA100	13-8178
J3	640442-5 MTA100	13-8140
J3	640442-4 MTA100	13-8170
•	**SWITCHES**	
S1	Centerlab PA600-210	08-6501
S2-S3	7101-SYZ-QE	08-6511
S4	30-1-PB GRAYHILL	08-6517
•	**MISCELLANEOUS**	
B1-B2	"D" Duracell Battery	21-9313
V1	M12S DETECTOR X-TAL/TUBE ASSEMBLY	47-1574 2004-061
*	BATTERY CONTACT SET	40-1707
*	CASTING	9363-481
*	MAIN HARNESS	8363-645
*	PORT. DEEP CAN ASSY	4363-615
*	PORTABLE KNOB	08-6613
M1	PORT. BEZEL FRONT ASSY	4363-188
*	METER BEZEL W/GLASS, W/O SCREWS	4363-352
*	METER MOVEMENT (1mA)	15-8030
*	PORTABLE METER FACE	7363-136
*	HARNESS- CAN (UNIMORPH)	8363-462
*	BATTERY LID W/LATCHSET	9363-332
*	PORTABLE 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
*	REPLCMT CABLE (STD 39")	40-1004
*	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

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


REVISIONS
EFF | AUTHORITY | ZONE | LTR | DESCRIPTION | DATE | APPROVED
SIGNAL FLYING LEAD
C57 100PF 3KV
R137 10K
Q96 2N3904
C106 0.001UF 100V
R70 4.7K
R18 1K
R27 22K
R89 100K
R80 100K
C103 10UF 20V
+1.22V
1/5 U1 CA3096 16=GND
R68 8.2K
R159 10K
R63 82K
R76 100 +5V
C126 10UF 20V
C115 100UF 10V
R78 22K
R64 1K
R87 10K
C109 0.01UF 100V
R91 4.7K
1/2 U2 TLC372
8=+5V,4=GND
C119 0.001UF 100V
R75 33K
P1 -12
C117 100PF 100V
1/2 U3 CD4098 16=+5V,8=GND
1/5 U4 CA3096 16=GND
R72 SPAN-SEE NOTE TYPICALLY 33K
R79 100K
C105 10UF 20V
R74 100K
OVERLOAD
P5 -1
P5 -2
P5 -3
P1 -13
P1 -8
P1 -7
P1 -10
P1 -11
R189 301 1% 1/3W
R190 150
R191 150
1/2 U6 TLC27M71P
R172 47K
+BAT
Q6 2N3904
R65 10K
8=+5V,4=GND
R36 10M
C42 0.0027UF 3KV
C40 0.0015UF 3KV
C41 0.0015UF 3KV
CR167 IN4007
CR166 IN4007
CR175 IN4007
CR169 IN4007
C191 0.0015UF 3KV
C38 0.0015UF 3KV
C102 100UF 10V
Q145 MPS6534
T165 L0050 9=GND,10=GND
7000T
C50 100PF 3KV
R47 1G
R138 1M
R147 SAT 715K TYPICALLY
C170 0.1UF 100V
CR94 IN4148
100T
200 R177
200T
C171 1UF 35V
C153 0.01UF 100V
1/2 U6 TLC27M71P
R46 10K
R66 1K
Q44 2N3904
P4 -1
P4 -2
P4 -3
+1.22V
EXT. HV
8=+5V,4=GND
R86 2.7M
R128 100K
C113 0.01UF 100V
1/2 U3 CD4098 16=+5V,8=GND
U5 ICM7555
RESET
CV
TRIG
THR
OUT
DIS
8=+5V,1=GND
R84 470K
C112 470PF 100V
P2 -2
P2 -1
P1 -6
P1 -4
P1 -2
P1 -5
P1 -1
P1 -3
P1 -9
+1.22V
R81 10K
U101 LM385Z-1.2
+BAT
R150 SAT 2.37K TYPICALLY
C104 47UF 16V
Q15 MPS6534
L13 470UHY
R77 2.2K
C56 100UF 10V
C121 330PF 100V
U7 MAX631
COMP
LX
LBI
V-OUT
CP
LBO
VFB
3=GND
C134 100UF 10V
+5V
NOTES:
1. P4 3 PIN MTA-100 FOR EXTERNAL HV CONNECTION (M5 & M14C) NOT REQUIRED ON STANDARD BOARD.
2. P5 3 PIN MTA-100 FOR OVERLOAD CONNECTION NOT REQUIRED ON STANDARD BOARD.
3. R72 SELECTED TO MATCH METERFACE - 15K, 22K, 33K.
1/2 U2 TLC372
8=+5V,4=GND UNUSED GATE
UPDATED CKD 06-JUL-00
DR ACF 18-AUG-99
CHK RDS 6/4/00
DSGN DW 17-OCT-91
APPD DSH 2-6-00
NEXT HIGHER ASSY.
LUDLUM MEASUREMENTS INC.
TITLE: MAIN BOARD
BOARD# 5363-641
SIZE C | MODEL 12S AND 19 | SERIES 363 | SHEET 488
09:51:47 6-Jul-00 5363641 SHEET 1 OF 1



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"

LUDLUM MEASUREMENTS INC. SWEETWATER, TX.			
DR CKB	06-JUL-00	TITLE: MAIN BOARD	
CHK RDS 6JuL00		BOARD: 5363-641	
DSGN DW	17-OCT-91	MODEL: 12S AND 19	
APP BSS 7-6-00		FILENAME: 8S363641	
		6-Jul-00	09:54:47
COMPONENT	SOLDER	REVISION	SERIES / SHEET
OUTLINE	OUTLINE	1.0	363 / 489

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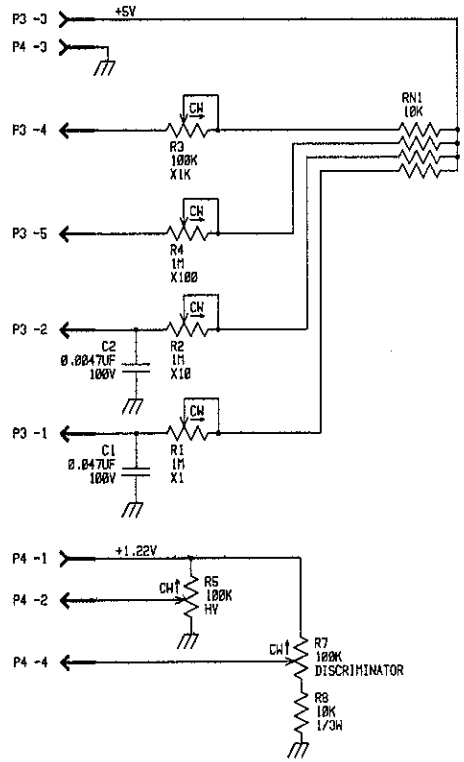
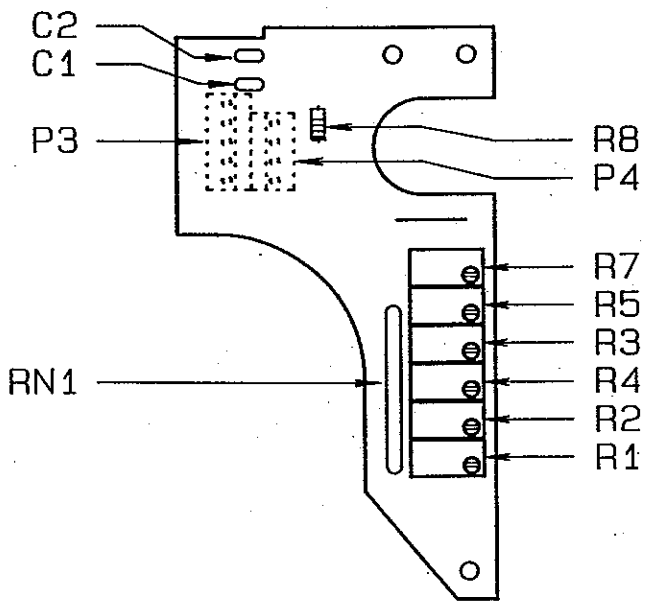
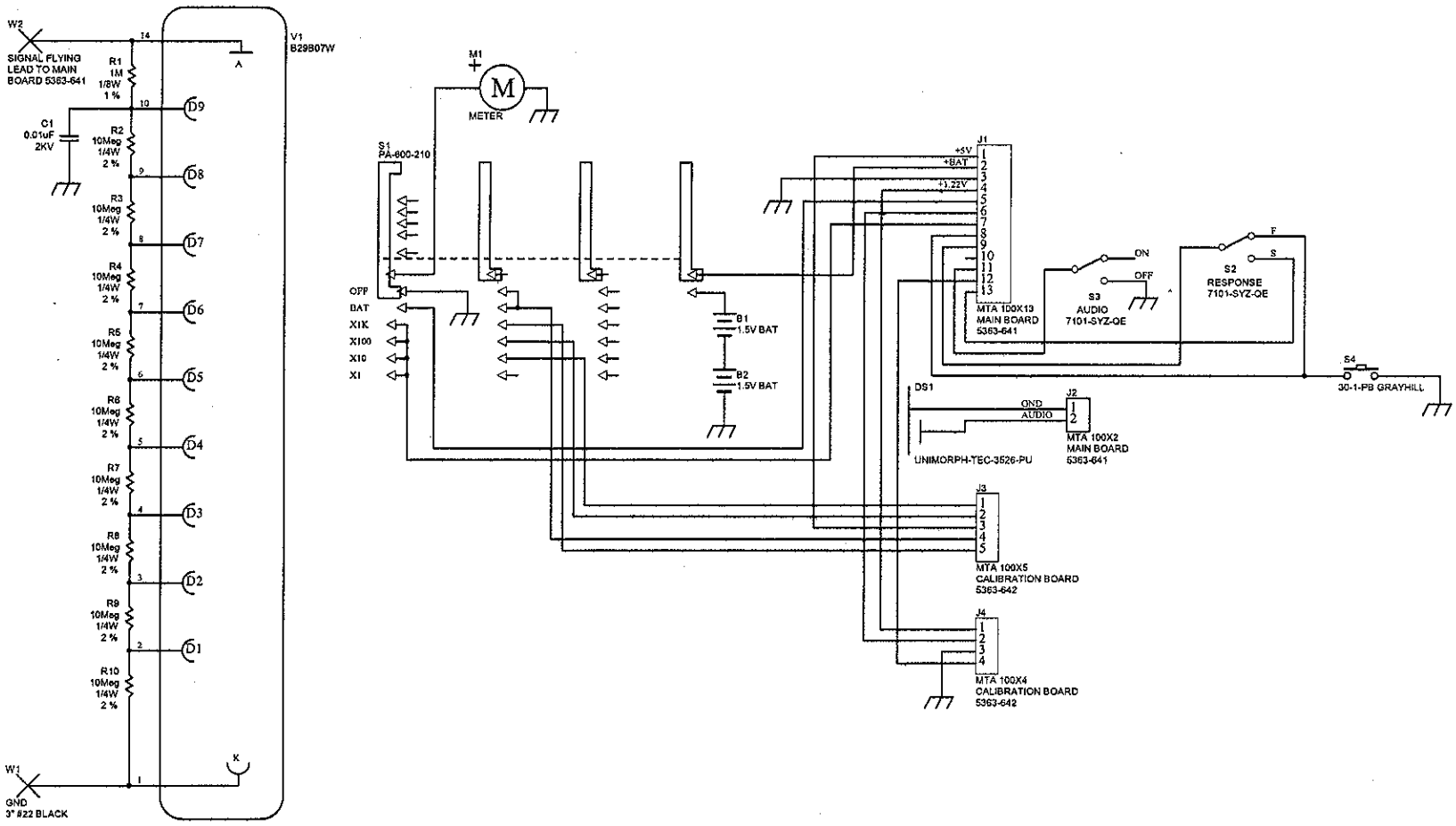


UPDATED	-	LUDLUM MEASUREMENTS INC.	
DR ACF	18-AUG-99	TITLE: CALIBRATION BOARD	
CHK KSS	8-18-99	BOARD# 5363-642	
DSGN	-	SIZE C / MODEL 12S / SERIES 363 / SHEET 490	
APPD JOW	8-18-99		
NEXT HIGHER ASSY. -			
14:56:28	18-Aug-99	S8363642	SHEET 1 OF 1



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

CHG	NO.			DWN	CHK	APP
DWN CKB	DATE 03/25/92	CHK	DATE 3-25-92	APP	DATE 3-25-92	
TOL: SHOP STD ☐ OTHER			SCALE: FULL ☒ OTHER			
TITLE MODEL 12S CALIBRATION BOARD						
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER TEXAS 79556			SERIES 363		SHEET 491	



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: P.W.	8-10-99	Board#: W464-057	
Approve: R.C.	8-12-99	Sheet: 1 of 1	Series 464 / Sheet 57
16:05:14	10-Aug-1999	Rev: 1.0	
X:\Projects\lmi\Portables\12S\Wiring Diagram\464X57.sch			