

**LUDLUM HIGH-RANGE
ALPHA ION CHAMBER**

**MODEL 195 READOUT UNIT
with MODEL 43-132 ION CHAMBER**

**June 2016
Serial No. 186163 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**

High-Range Alpha Ion Chamber

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High-Range Alpha Ion Chamber

High-Range Alpha Ion Chamber

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1. GENERAL

The high-range alpha ion chamber utilizes the Model 43-132 ion chamber and the Model 195 readout unit.

The Model 43-132 is designed to enhance alpha detection, although it is also sensitive to beta-gamma radiation.

2. SPECIFICATIONS FOR MODEL 43-132

WINDOW: 0.4 mg/cm² metalized polyester; 100 cm² with 83% open grid

CHAMBER VOLUME: approximately 100 cm³

FEET: window screws provide spacing of 0.28 cm (0.11 in.)

WINDOW SPACING: alpha window spaced 0.25 cm (0.10 in.) from front surface of detector

POWER REQUIREMENTS: 85 volts for the electrode and 85 +12/-1.2 volts for the electrometer (all nominal ±5% voltages)

CABLE: 5-pin DIN-type connector with 3 m (10 ft) cord

SIGNAL OUT: analog from 0 to 12 volts

TEST: a push-button switch on the back of the probe. Depress switch for a reading of approximately 225×10^6 dpm ±25%. Take the reading before and after using to confirm detector operation. Test data is only for when the Model 195 is used with the probe.

CALIBRATION CONTROL: Remove the CAL COVER to expose four holes.

- The first small hole exposes a subsurface control to allow adjustment of the electrometer offset.
- The second hole exposes a subsurface control to allow adjustment of the probe signal output.
- The third (large) hole allows access to the guard voltage.
- The fourth hole allows access to the anode voltage.

SIZE: 20.3 x 10.2 x 10.2 cm (8 x 4 x 4 in.) (L x W x H)

WEIGHT: 0.50 kg (1.1 lb)

CONSTRUCTION: aluminum body with solder-plated phenolic electrode and 0.4 mg/cm² window with stainless steel protective grid

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3. SPECIFICATIONS FOR MODEL 195

RANGE: **High Range** reads as 0 to 1999 million dpm, but the usable range is 0 to 900 million dpm. **Low Range** is 0 to 19.99 million dpm.

READOUT: 3½-digit LED

AUDIO: headset for audio. Sound frequency increases as meter reading increases.

RESPONSE: approximately 5 seconds to 90% of final reading

CONNECTOR: 5-pin DIN

POWER: 2 to 3 volts at 50 milliamps, provided by two “D” size batteries

CALIBRATION CONTROLS: individual recessed potentiometers for HI/LO Gain and Balance (BAL)

NUL: surface control for adjusting offset for zero

WARM-UP TIME: allow 5 minutes settling time after initial turn-on

SIZE: 17.0 x 8.9 x 21.6 cm (6.7 x 3.5 x 8.5 in.) (H x W x L)

WEIGHT: 1.2 kg (2.7 lb)

FINISH: computer beige, powder-coated with silk-screened nomenclature

INSTRUMENT CONSTRUCTION: drawn-and-cast aluminum case

4. DESCRIPTION OF CONTROLS AND FUNCTIONS

Range Selector Switch: A four-position switch marked OFF, BAT, HI, and LO. Turning the range selector switch from OFF to BAT position provides the operator with a battery check of the instrument (see BAT OK lamp function below). Moving the range selector switch to the HI range position provides the operator with full-scale reading of 1,999 million dpm (usable only to 900 million dpm). Moving the range selector switch to the LO range position provides the operator with full-scale reading of 19.99 million dpm.

BAT OK lamp: illuminates when the Range Selector Switch is in the BAT position and when the battery voltage is above 2 volts. The illumination level is very dim when switched to the operating position to conserve power.

NOTE: Batteries should be replaced if the lamp does not illuminate.

Range Calibration Adjustments: Recessed potentiometers located under the calibration cover (CAL), on the right side of the front panel. The HI control adjusts the high-range reading when the HI position is selected with the Range Selector Switch. The LO control adjusts the low-range reading when the LO position is selected with the Range Selector Switch. The BAL control adjusts the LO zero reading, matching the HI zero reading.

NUL Control: The NUL control is adjusted to zero the display. Indication may be negative if over-adjusted.

AUDIO: 1/8 inch jack for headset. At low readings, the audio clicks. At higher readings, a continuous tone with increasing frequency as meter reading increases.

AUDIO ON/OFF: Switches audio off.

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5. OPERATING PROCEDURES

NOTE: To open the battery lid, twist the lid button counterclockwise a 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.
- Connect the Model 43-132 detector to the Model 195 ion chamber.
- Turn the instrument range selector switch to BAT. The BAT OK lamp should illuminate. If the lamp does not illuminate, recheck to be certain that the batteries have proper polarity or replace batteries with fresh batteries.
- Turn the instrument to the LO position. Allow five minutes for the chamber wall to stabilize.

- After the warm-up period, adjust the NUL control for a reading of 0.00 ± 0.02 when not exposed to a radiation source.

- Expose the instrument to an alpha check source, taking care that the source is placed in a reproducible position and distance relative to the window.

NOTE: The instrument calibration is very sensitive to the distance from the window to the source surface and also to the presence of dirt on the surface of the window or source.

- If the NUL check and source check (above) are acceptable, proceed to use the test function.
- Remove the detector from the check source. Switch to high range and depress the probe test switch. Record reading at 225×10^6 DPM $\pm 25\%$.
- Proceed to use instrument.

6. CALIBRATION

CALIBRATION OF MODEL 195:

Calibration controls are under the CAL cover on the front panel. The controls may be adjusted with an 1/8-inch blade screwdriver.

AUDIO CALIBRATION: Internal control R33 is adjusted clockwise to allow 2-5 clicks per second with meter reading at zero. This control set is set at factory and should not require adjustment.

- Check for fresh batteries, turn the instrument ON, ensure that the BAT OK lamp illuminates, and allow the instrument to stabilize for 10 minutes.
- Disconnect the Model 43-132.
- Remove the calibration cover.
- Switch to the HI position.
- With no source present, adjust the NUL control so that the display reads -000/000.
- Switch to the LO position.
- Adjust BAL for display reading of 0.00/-0.00.
- Connect the Model 43-132. After stabilizing, adjust NUL for zero reading.
- Expose the detector to the calibration source and adjust the LO control for the proper reading.
- Remove the source and re-adjust the BAL control for a 0.00 ± 0.02 reading, if required.
- Re-position the source and readjust the LO control for the proper reading, if required.

- After the NUL and LO controls are finalized, expose the source to the detector, then switch to the HI setting. Adjust the HI control for the proper reading.

NOTE: The instrument is calibrated with a 7.6 million dpm source, which is less than 0.5% of a full-scale reading. The user is responsible for procuring higher-range sources for final calibration.

If a higher-range source of 40-100 million dpm is secured, the calibration may be extended by using a high-range gamma field. Presume the instrument is calibrated at 40 million dpm alpha, then cover the window with a 1/8-inch thick sheet of acrylic. Expose the detector to a gamma field for an instrument reading of 40 million dpm and note the gamma field level. Increase the field by 10 times to confirm calibration of the HI scale.

CALIBRATION OF MODEL 43-132:

If several detectors are to be used with one Model 195, select the detector with the lowest gain.

- Confirm that the gain control is fully clockwise (highest gain).
- Turn the Model 195 on. Confirm that the detector is **NOT** connected to Model 195.
- Set the Model 195 Null to 0.00 ± 0.02 on low scale.
- Connect the Model 43-132 to Model 195.
- Remove the Model 43-132 calibration cover.
- Adjust the electrometer bias control (first control) for a Model 195 reading of 0.00 ± 0.02 .

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- Expose the Model 43-132 to the calibration source.
- Adjust the Model 195 low control for source reading.
- Remove the source and confirm Null at 0.00 ± 0.02 .
- Replace the source and reduce source reading 2-5% by adjusting the Model 43-132 gain control.
- Adjust the Model 195 low control to bring source reading back to source value.
- Now adjust the electrometer bias control and gain control on remaining detectors for a no-source reading of 0.00 ± 0.02 without source and source reading with source.

Electronic Simulation of Higher Ranges

- 1) Secure a calibrated Model 195 with a calibrated Model 43-132.
- 2) Connect the isolated power supply as follows:
 - a. The positive lead through the back of the probe to the guard.
 - b. The negative lead through the back of the probe, through a 200 meg resistor, to the anode.
 - c. Adjust the voltage for the calibrated reading.
 - d. Now adjust for a more negative voltage. The meter reading should increase in a linear ratio.

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PARTS LIST

Ref. No.	Description	Part No.	Ref. No.	Description	Part No.
High-Range Alpha Ion Chamber			MODEL 43-132 CHASSIS PARTS		
UNIT	Completely Assembled Model 43-132 Ion Chamber		47-3234	CONN-640442-5 MTA 100	13-8140
			*	CABLE – DIN 49153A-S2-10	21-9893
			*	HANDLE	7475-054
			*	COVER (SCREEN)	
				83% OPEN	7475-052
			*	M43-130 WINDOW	7475-025
			*	M43-130 BACK SHELL	7475-026
			*	CALIBRATION COVER	9475-058
			*	SWITCH PIN	7475-063
			*	3/16 E RING	21-9597
			*	SPRING LEE LC-016C-13	21-9936
Detector Anode Board, Drawing 475 X 29			ACCESSORIES		
BOARD	Assembled Detector Anode Board	5475-021		CABLE EXT. 0.91 m (3 ft)	8303-721-3
				CABLE EXT. 3 m (10 ft)	8303-721
				CABLE EXT. 30 m (100 ft)	8303-721-100
CAPACITORS					
C1	0.01µF, 200V, X7R	04-5725			
DIODES					
CR1	LM4041	05-5896			
INTEGRATED CIRCUITS					
U1	LMC6041IM	06-6502			
RESISTORS					
R1	200M, 1%	12-7060			
R2	1M, 1%	12-7844			
R3	274k, 1%	12-7963			
R4	100K TRMR	09-6829			
R5	1k, 1%	12-7832			
R6	10G, 5%	12-7069			
R7	100k, 1%	12-7834			
R8	10K, 1%	12-7839			
R9	1M, 1%	12-7844			
R10	1M TRMR	09-6778			
CONNECTORS					
J1	640457-5 MTA 100	13-8102			
MISCELLANEOUS					
A1	DETECTOR ANODE	6475-021			
			UNIT	Completely Assembled M195 Digital Readout Unit	48-3233
			Main Circuit Board, Drawing 475 X 66		
			BOARD	Assembled Circuit	5475-066
			CAPACITORS		
			C1-C2	1µF, 35V	04-5656
			C3	0.001µF, 100V	04-5659
			C4	1µF, 6.3V	04-5656
			C5	0.01µF, 200V	04-5725
			C6	0.01µF, 500V	04-5696
			C7	0.1µF, 200V	04-5710
			C8	100pF, 100V	04-5661
			C9	1µF, 35V	04-5656
			C10	0.1µF, 200V	04-5710
			C11	1µF, 35V	04-5656
			C12	0.01µF, 500V	04-5696
			C13-C17	1µF, 35V	04-5656
			C18	68µF, 6.3V	04-5654
			C19	1µF, 35V	04-5656
			C20	68µF, 6.3V	04-5654
			C21	1µF, 35V	04-5656

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Ref. No.	Description	Part No.	Ref. No.	Description	Part No.
C22	0.001 μ F, 100V	04-5659			
C23	0.01 μ F, 200V	04-5725			
C24	100pF, 100V	04-5661			
C25	0.001 μ F, 100V	04-5659			
C26	10 μ F, 25V	04-5728			
C27	100pF, 100V	04-5661			
C28	0.47 μ F, 50V	04-5681			
C29	0.01 μ F, 50V	04-5664			
C30	10 μ F, 25V	04-5655			
TRANSISTORS					
Q1	MMBT3904LT1	05-5841			
Q2	2N7002L	05-5840			
INTEGRATED CIRCUITS					
U1	LT1304CS8	06-6394			
U2	MIC1557BM5	06-6457			
U3	LT1304CS8	06-6394			
U4	LM285M-1.2	05-5845			
U5	LT1304CS8-5	06-6434			
U6	LT1304CS8	06-6394			
U7	MIC1557BM5	06-6457			
U8	LMC7111BIM5X	06-6410			
U9	AD654JR	06-6317			
U10	LMC6462AIM	06-6584			
VOLTAGE REGULATOR					
VR1	LT1761ES5-SD	06-6585			
DIODES					
CR1	CMSH1-40M	07-6411			
CR2	BZX84C18	07-6447			
CR3	MMBD914LT1	07-6353			
CR4	CMSH1-40M	07-6411			
CR5	MMBD914LT1	07-6353			
CR6	CMSH1-40M	07-6411			
CR7	CMPD2004S	07-6402			
CR8-CR10	CMSH1-40M	07-6411			
CR11	BZX84C18	07-6447			
CR12-CR13	MMBD914LT1	07-6353			
CR14-CR15	BZX84C18	07-6447			
CR17	BZX84C18	07-6447			
				RESISTORS	
			R1	18.7k, 1/4W, 1%	12-7051
			R2	110k, 1/8W, 1%	12-7052
			R3	100k, 1/8W, 1%	12-7834
			R4	1M, 1/8W, 1%	12-7844
			R5	150k, 1/8W, 1%	12-7833
			R6-R8	10M, 1/8W, 1%	12-7996
			R9	1M, 1/8W, 1%	12-7844
			R10	75k, 1/8W, 1%	12-7876
			R11	475k, 1/8W, 1%	12-7859
			R12	12.1k, 1/8W, 1%	12-7879
			R13	110k, 1/8W, 1%	12-7052
			R14	100k, 1/8W, 1%	12-7834
			R15	150k, 1/8W, 1%	12-7833
			R16	1M, 1/8W, 1%	12-7844
			R17	100k, 1/8W, 1%	12-7834
			R18	1M, 1/8W, 1%	12-7844
			R19	100k, 1/8W, 1%	12-7834
			R20	10 OHM, 1/8W, 1%	12-7836
			R21	21.5k, 1/8W, 1%	12-7001
			R22	1M, 1/8W, 1%	12-7844
			R23	121k, 1/8W, 1%	12-7014
			R24-R25	1M, 1/8W, 1%	12-7844
			R27-R29	100K, 1/8W, 1%	12-7834
			R30-R31	475K, 1/8W, 1%	12-7859
			R32	10, 1/8W, 1%	12-7836
			R33	100K, TRMR	09-6910
			R34	4.75M, 1/8W, 1%	12-7995
			R35	8.25K, 1/8W, 1%	12-7838
			R36	7.75K, 1/8W, 1%	12-7858
			R37	47.5K, 1/8W, 1%	12-7872
			R38	5.62K, 1/8W, 1%	12-7871
			R39	1K, 1/8W, 1%	12-7832
			R40	10K, 1/8W, 1%	12-7839
				CONNECTORS	
			J1	1-640456-5 MTA100	13-8355
			P5	640456-4 MTA100X4	13-8088
				INDUCTORS	
			L1	22 μ H CD43-220	21-9808
				TRANSFORMERS	
			T1	ELECTROMETER POWER	21-9825
			T2	ANODE POWER	21-9925
			T3	ELECTROMETER POWER	21-9825
			T4	M 195 AUDIO	4275-164

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	Ref. No.	Description	Part No.
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Chassis Wiring Diagram, Drawing 475 X 69

Ref. No.	Description		Part No.
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MISCELLANEOUS

Calibration Board, Drawing 475 X 24

BOARD	Assembled Calibration		5475-018
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DS1	L58D-G2-W		07-6448
S1	SW-PA-600-210		08-6501
S2	SW-7101-SYZ-QE		08-6511
R1	100K TRMR		09-6959
P4	RECPT- 5 PIN		13-8581
B1-B2	BATTERIES – ‘D’ CELL		21-9313
J6	JACK TINI #42		21-9333

RESISTORS

R1	TRMR-10k		09-6787
R2	TRMR-100k		09-6813
R3	332k, 1/8W, 1%		12-7976
R4	52.3k, 1/8W, 1%		12-7869
R5	5.11k, 1/8W, 1%		12-7909
R6	52.3k, 1/8W, 1%		12-7869
R7	75k, 1/8W, 1%		12-7876
R8	5.11K, 1/8W, 1%		12-7909
R9	150k, 1/8W, 1%		12-7833
R10-R13	52.3k, 1/8W, 1%		12-7869
R14	249K, 1/8W, 1%		12-7862
R15	100K, 1/8W, 1%		

CONNECTORS

J1	MTA100X15 MAIN		13-8383
J2	MTA100X9 CAL		13-8169
J3	MTA100X12 LCD ASSY		13-8407
J5	MTA100X4 MAIN		13-8170

DIODES

CR1	LM4041CM1M3-1.2		05-5896
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INTEGRATED CIRCUITS

U1	LMC6462		06-6584
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CONNECTORS

P2	640456-9 MTA100		13-8094
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**High-Range Alpha Ion Chamber
June 2016**

DRAWINGS AND DIAGRAMS

PU Detector Anode Board, Drawing 475 x 29

PU Detector Anode Board Component Layout, Drawing 475 x 30 (2 sheets)

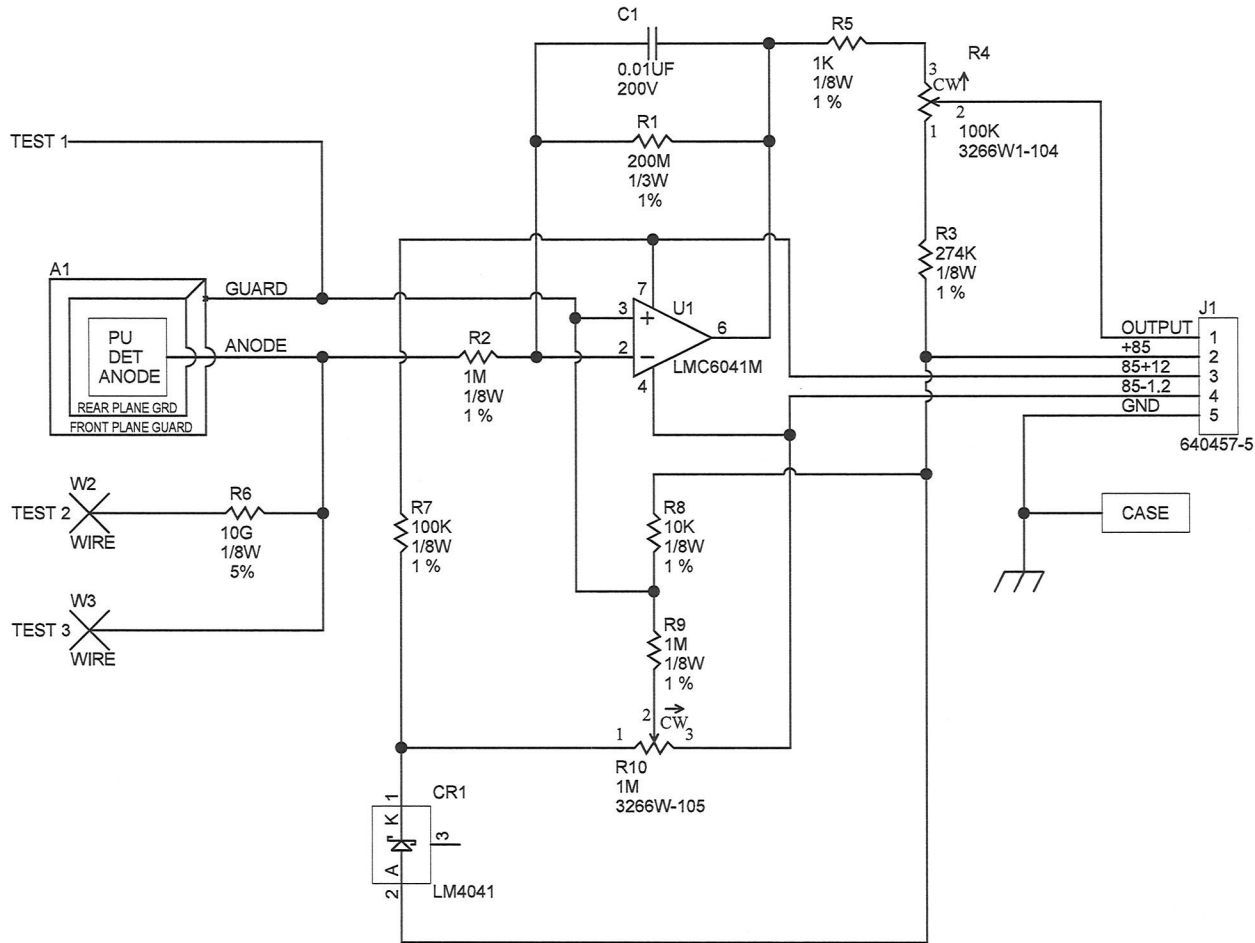
Model 195 Main Circuit Board, Drawing 475 x 66A, 66B, and 66C

Model 195 Main Circuit Board Component Layout, Drawing 475 x 67A

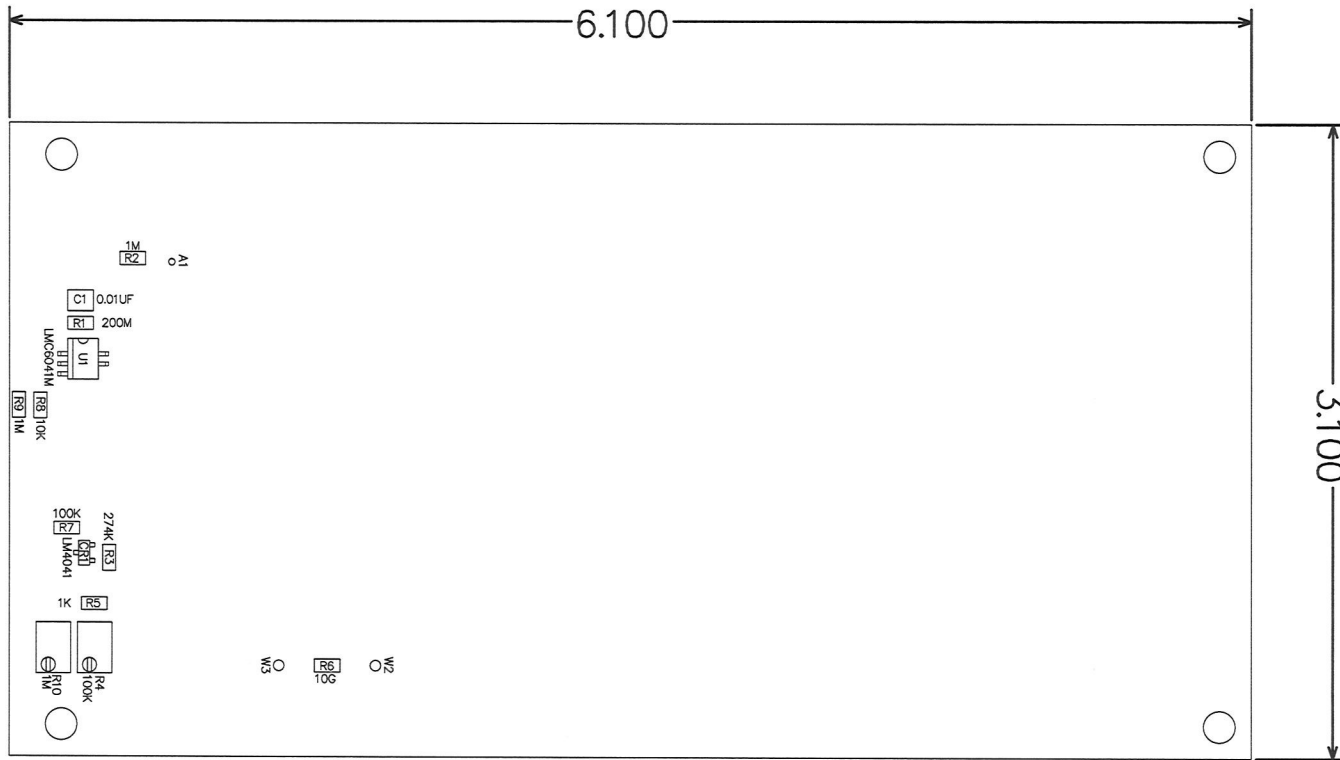
PU Detector Calibration Board (Model 195), Drawing 475 x 24

PU Detector Calibration Board (Model 195) Component Layout, Drawing 475 x 25 (2 sheets)

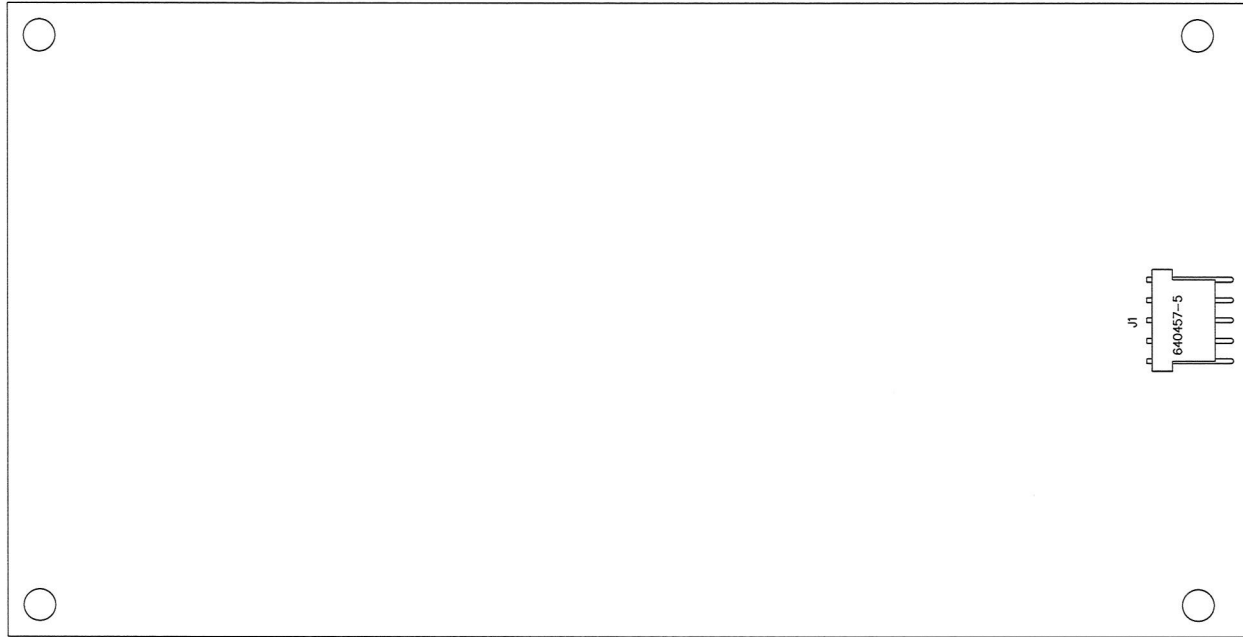
Model 195 Wiring Diagram, Drawing 475 x 69




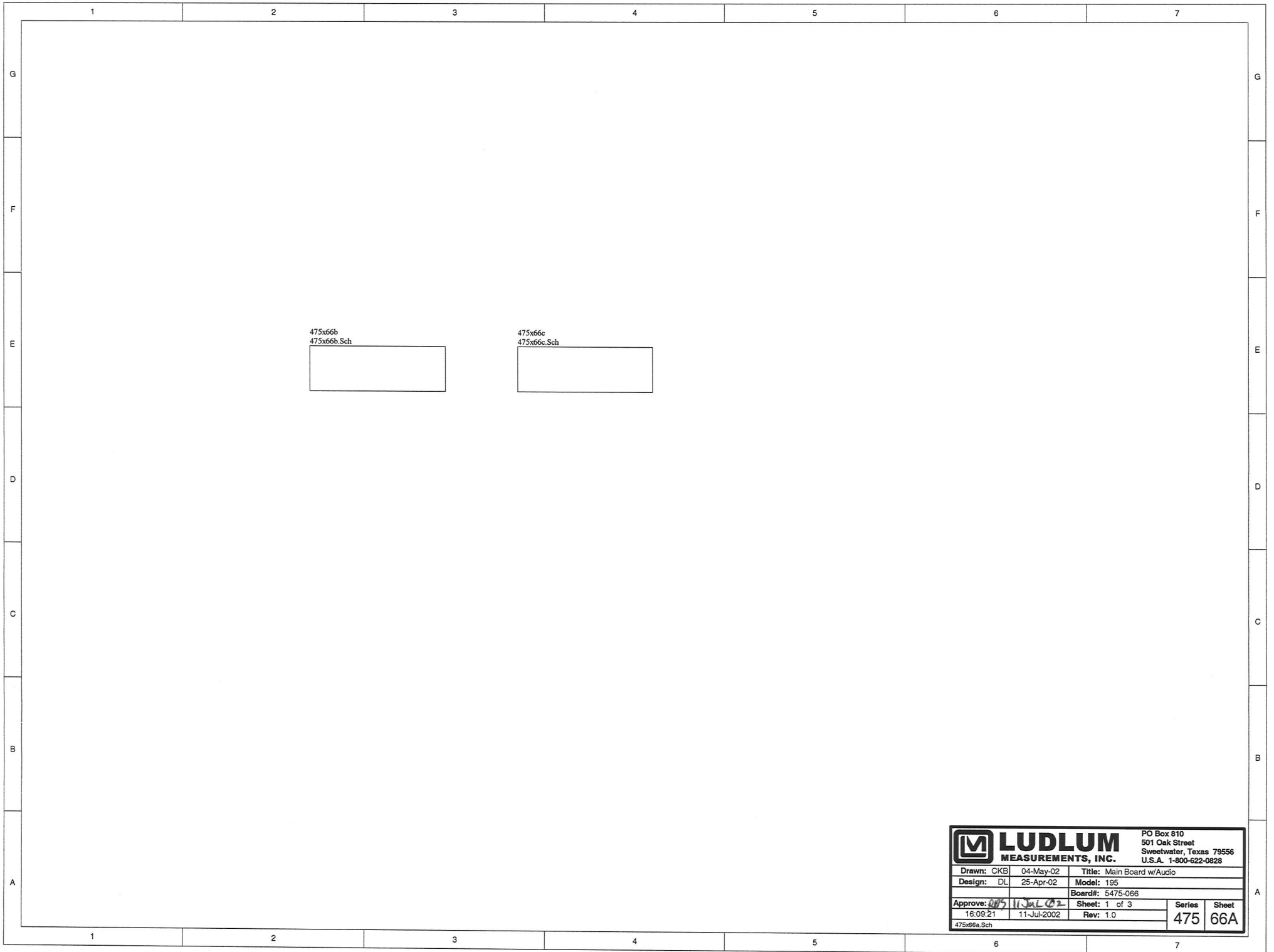
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Design: DL	03/19/2002	Model: 195		
		Board#: 5475-021		
Approve: [Signature]	03/19/2002	Sheet: 1 of 1		Series
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		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
		Title: PU DETECTOR ANODE	
Drawn: JK	03/19/2002	Model: 195	
Design: DL	03/19/2002	Board#: 5475-021	
Approve: JMC	050612	Rev: 2	
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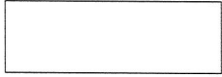


		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828		
		Title: PU DETECTOR ANODE		
Drawn: JK	03/19/2002	Model: 195		
Design: DL	03/19/2002	Board#: 5475-021		
Approve: <i>JM</i>	<i>05 DEC 12</i>	Rev: 2		
Print Date: 12/5/2012 12:51:57 PM		SCALE: 1.00 Bottom Overlay	Series: 475	Sheet: 30
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475x66b

475x66b.Sch

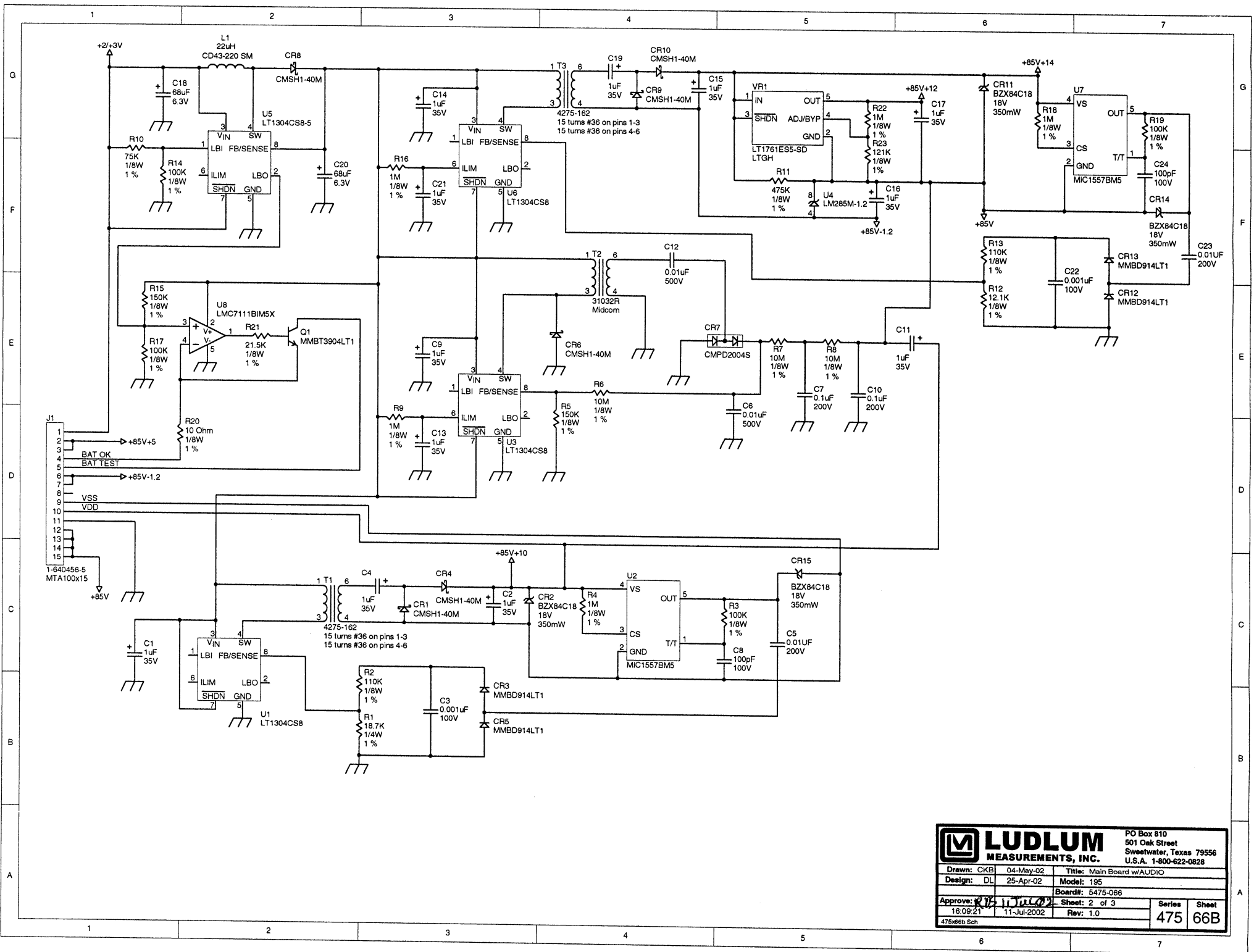


475x66c

475x66c.Sch



		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828		
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		Drawn: CKB Design: DL Approved: <i>[Signature]</i> 18.09.21 47566b.Sch	04-May-02 25-Apr-02 11-Jul-2002

P5
640456-4
MTA100x4
AUDIO

1 2 3 4 5 6 7

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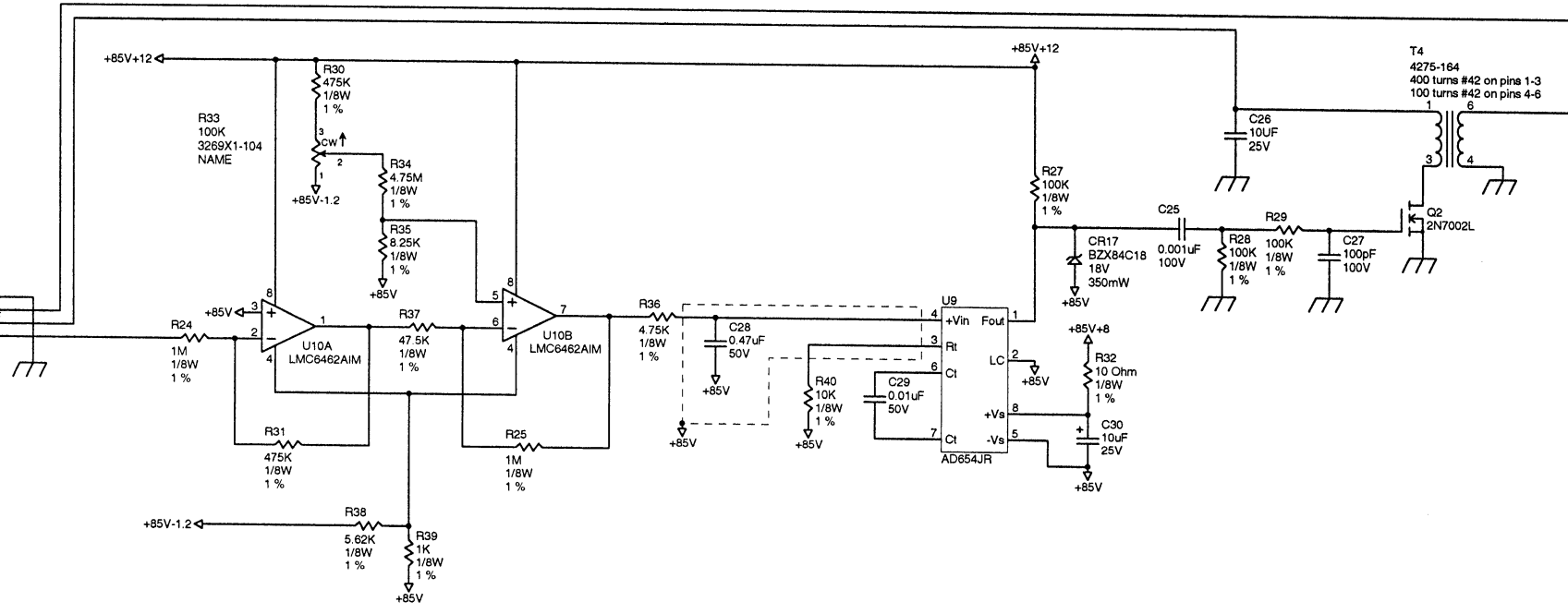
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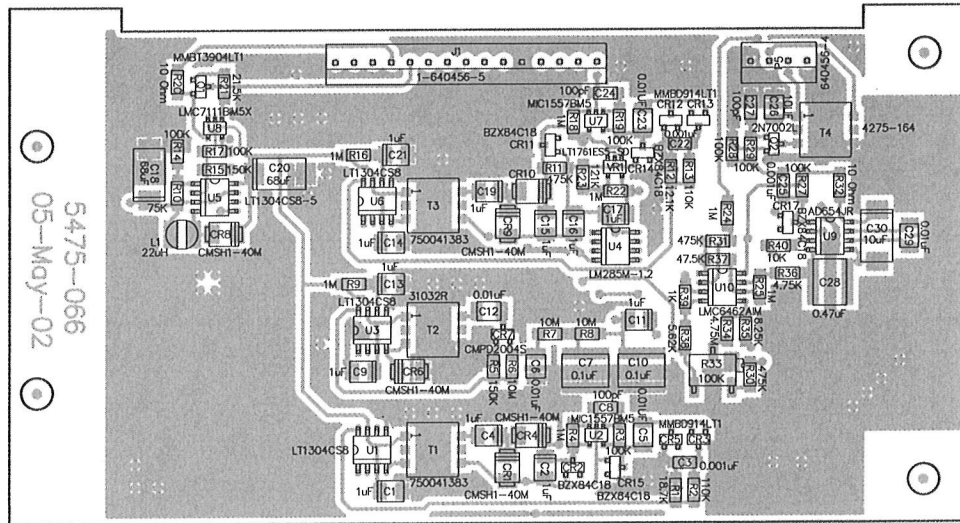
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A



LUDLUM MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
Drawn: CKB	04-May-02	Title: Main Board w/Audio	
Design: DL	25-Apr-02	Model: 195	
Approve: <i>[Signature]</i>	11-Jul-02	Board#: 5475-066	
16:09:22	11-Jul-2002	Rev: 1.0	Series: 475 Sheet: 66C

1 2 3 4 5 6 7



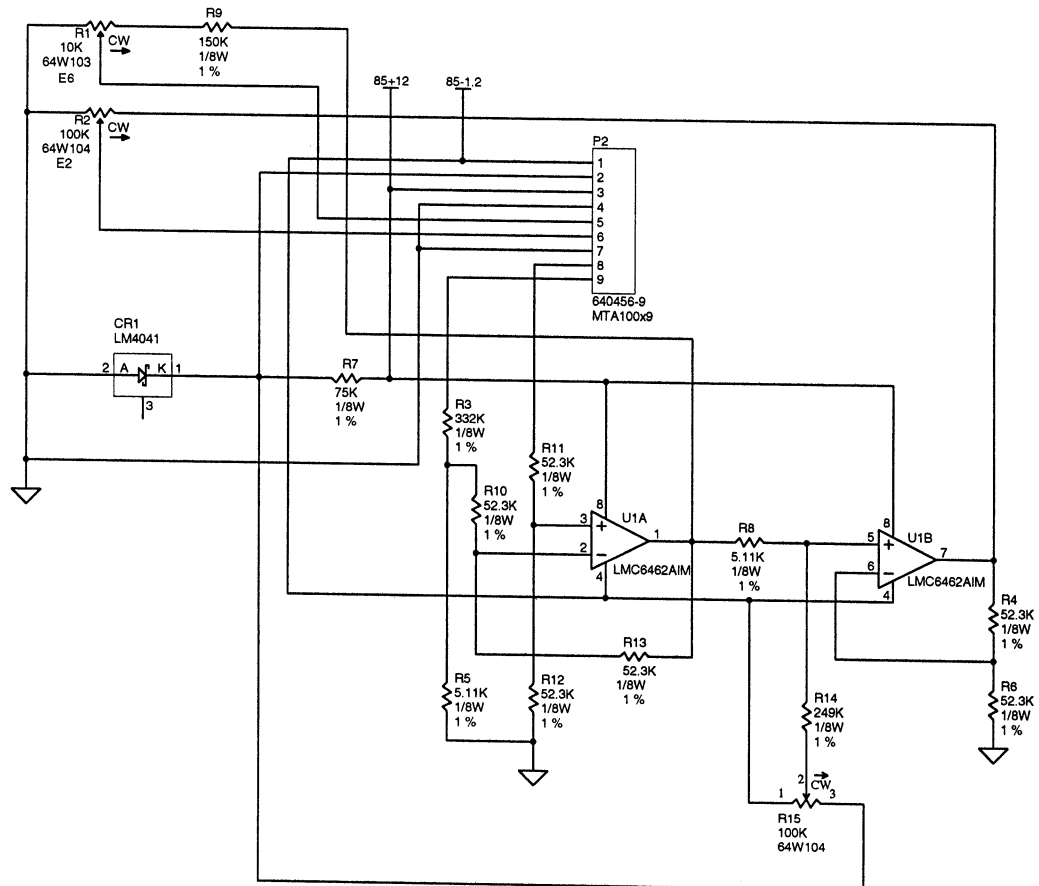
5475-066
05-May-02

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Sweetwater, TX 79556
U.S.A. 1-800-622-0828

Title: Main Board w/Audio

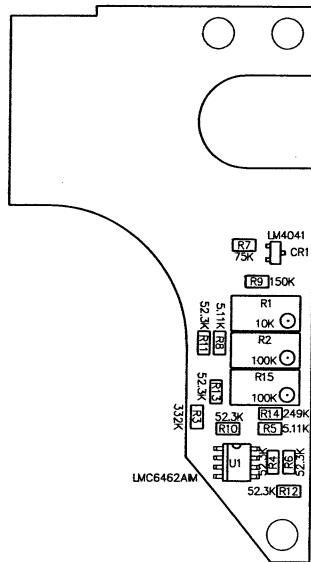
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Approve: R33	2/20/2016	Rev: 1
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Print Date: 4/28/2016	9:15:33 AM	Series 475
Top Overlay		Sheet 67A

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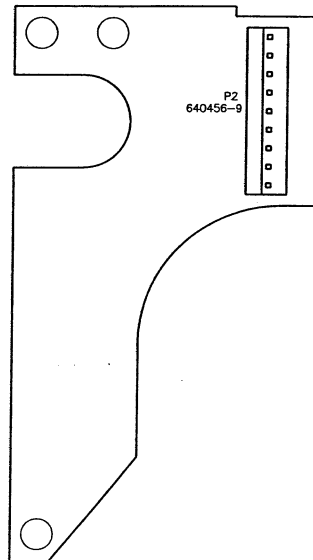


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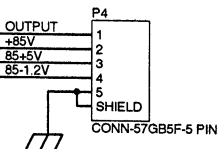
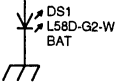
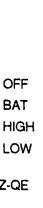
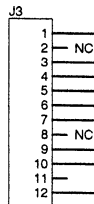
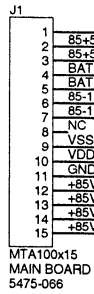
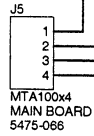
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Design: DL	08-DEC-00	Model: M195 PU DETECTOR
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Approved: <i>DL</i>		Sheet: 1 of 1
17:07:18	22-May-2002	Rev: 2.0
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		Sheet: 24



Drawn:	JK	28-MAY-02	Title: PU DETECTOR CAL BOARD	
Design:	DL	28-MAY-02		
Check:	CRB	28-May-02	Model: M195 PU DETECTOR	
Approve:	K	28 May 02	Board#: 5474-018	
Layer:	Top Overlay		Rev: 2.0	Series
Mech.1	MID:		SCALE: 0.95	475
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Mech.3				25
Mech.4				



Drawn:	JK	28-MAY-02	Title:	PU DETECTOR CAL BOARD	
Design:	DL	28-MAY-02	Model:	M195 PU DETECTOR	
Check:	CKB	28-MAY-02	Board#:	5474-018	
Approve:	RSS	28-May-02	Rev:	1.0	Series
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Mech2					
Mech3	15:52:39	28-May-2002			
Mech4					



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Drawn: CKB	22-May-02	Title: Wiring Diagram w/Audio	
Design: DL	02-Feb-01	Model: 195	
Check: <i>RC</i>	<i>22 May 02</i>	Board#: 475-067	
Approve: <i>CS</i>	<i>22 May 2002</i>	Sheet: 1 of 1	Series
16:49:52	22-May-2002	Rev: 1.0	475
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