

**LUDLUM MODEL 43-147  
ALPHA/BETA DETECTOR**

**March 2019**

**LUDLUM MODEL 43-147  
ALPHA/BETA DETECTOR**

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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.

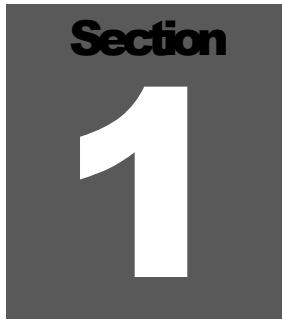
**LUDLUM MEASUREMENTS, INC.  
ATTN: REPAIR DEPARTMENT  
501 OAK STREET  
SWEETWATER, TX 79556**

**800-622-0828 325-235-5494  
FAX 325-235-4672**

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A dark gray square graphic with the word "Section" in white at the top and a large white number "1" in the center.

## Introduction

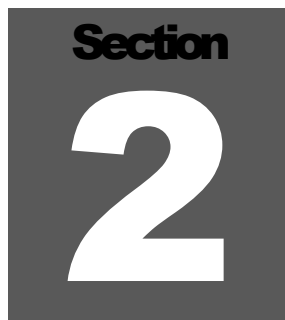
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The Model 43-147 detector is designed for alpha-beta surveying when coupled with compatible instruments. Functionally, these two detectors are very similar but differ in the type of protective window screen and the size of the active and open window areas.

Discriminating between alpha and beta radiation simultaneously requires the counting instrument to have either separate power supplies or window/threshold controls for each channel. The Ludlum Model 2929 Scaler, Model 2223, Model 2224, or Model 2360 instruments provide the necessary circuitry for simultaneous alpha-beta discrimination.

A Zinc Sulfide [ZnS (Ag)] scintillator is used for detecting alpha particles, and a thin plastic scintillator is employed for detecting beta radiation. The scintillation material is covered by metallized polyester to reduce light response, limiting excessive background counts. The Model 43-147 window is protected by an 88% open square-hole screen.

The photomultiplier tube (PMT) and crystal assembly may easily be removed for repair. Refer to the assembly view drawing in section 5 of this manual for details on construction and parts. The photomultiplier tube typically operates between 500 and 1200 volts with a recommended maximum of 1500 volts.

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## Specifications

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**Photomultiplier Tube:** 2.9 cm (1.1 in.) diameter; magnetically shielded

**Scintillator Material:** Zinc Sulfide [ZnS (Ag)] deposited on a 0.25 mm (0.010 in.) rectangular plastic scintillator

**Removable Protective Screen:** 0.79 mm (0.03 in.) thick, 6.5 mm (0.26 in.) square openings, 88% open

**Screen Outer Dimensions:** 225.4 x 113.7 mm (8.875 x 4.75 in.) (L x W)

**Window:** 1.2 mg/cm<sup>2</sup> metalized polyetser

**Window Area:**

**Active area:** approximately 200 cm<sup>2</sup>

**Open area:** approximately 176 cm<sup>2</sup>

**Efficiency (4 $\pi$ ):** typically 13% for <sup>99</sup>Tc, 20% for <sup>90</sup>Sr <sup>90</sup>Y, and 20% for <sup>239</sup>Pu

**Background** (in a 10 $\mu$ R/hr field):

Alpha: 3 cpm or less

Beta: 400 cpm or less

**Cross Talk:**

Alpha to Beta: < 10%

Beta to Alpha: < 1%

**Response Uniformity:** 10% or less from average reading

**Operating Voltage:** typically 500-1200 Vdc (1500 Vdc max.)

**Dynode String Resistance:** 60 megohm

**Gamma Sensitivity:** 15-20 cpm/ $\mu$ R/hr ( $^{137}\text{Cs}$ )

**Dead Time:** typically 5  $\mu$ sec or less

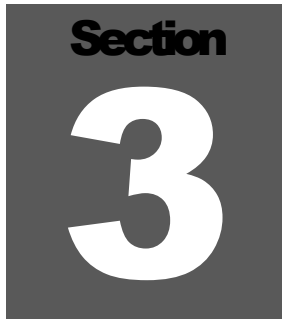
**Connector:** Series "C" unless otherwise specified

**Temperature Range:** -20 to 50 °C (-4 to 122 °F)

**Overall Size:** 10.7 x 12.1 x 35.6 cm (4.2 x 4.75 x 14 in.) (H x W x L), plus feet

**Weight:** 0.7 kg (1.0 lb)

**Construction:** aluminum housing with beige powder-coat finish

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## Safety Considerations

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### Environmental Conditions for Normal Use

Indoor or outdoor use

No maximum altitude

Temperature range of -20 to 50°C (-4 to 122 °F)

Maximum relative humidity of less than 95% (non-condensing)

### Cleaning Instructions and Precautions

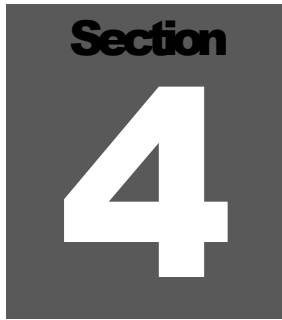
The detectors specified in this manual may be cleaned externally with a damp cloth, using only water as the wetting agent. Do not immerse the detector in any liquid. Do not attempt to clean a detector that is attached to an instrument providing high voltage. Disconnect the detector cable before cleaning.

### Returning for Repair or Calibration

To return an instrument for repair or calibration, provide sufficient packing material to prevent damage during shipment.

Every returned instrument must be accompanied by an **Instrument Return Form**, which can be downloaded from the Ludlum website at [www.ludlums.com](http://www.ludlums.com). Find the form by clicking the “Support” tab and selecting “Repair and Calibration” from the drop-down menu. Then choose the appropriate Repair and Calibration division where you will find a link to the form.




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## Parts List

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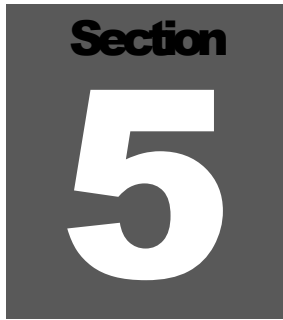
**For Model 43-147**
**Assembly View,  
Drawing 393 x 288**

<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
UNIT	Completely Assembled Model 43-147 200 cm <sup>2</sup> Alpha /Beta Scintillator	47-4092

<u>Quantity</u>	<u>Description</u>	<u>Part Number</u>
1 ea	Welded Body Assembly	2393-289
1 ea	Mirror	7393-297
1 ea	Connector Cap	7393-102
1 ea	Mylar Window Assembly	4393-299
1 ea	Window Frame	7393-295
1 ea	Face Ring	7393-291
1 ea	Square Screen (external snap-on screen)	7393-292
1 ea	Backup w/Plastic Scintillator and ZnS	4393-300
1 ea	Plastic Scintillator- EJ444L-2.94 x5.91x 0.010	7393-294
1 ea	Photomultiplier Tube	01-5238
1 ea	Voltage Divider Board	5435-182
*	Foil-NETIC	01-5019
*	Foil-CO-NETIC	01-5026
9 ea	Sponge	7002-065-04
1 ea	Tube Holder Assembly	2393-117
1 ea	Gasket	7393-296
1 ea	O-Ring	16-8366
1 ea	Series "C" Connector RECPT-UG706/U	4478-011
1 ea	M 43-93 Vinyl Cover	7393-162

**1 1/8-inch Voltage  
Divider Board,  
Drawing 435 × 1700**

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
	BOARD	Completely Assembled 1 1/8 inch Voltage Divider Board	5435-533
CAPACITORS	C1- C3	0.01uF, 200V	04-5725
	C4	0.0047uF, 3KV	04-5958
RESISTORS	R1	10M, 1/8W, 1%	12-7996
	R2	7.5M, 1/8W, 5%	12-7971
	R3-R10	10M, 1/8W, 1%	12-7996
	R11	2.21M, 1/8W, 1%	12-7002
	R12-R13	6.04M, 1/8W, 1%	12-7071
MISCELLANEOUS	*	SOCKET 1 1/8" PCB MOUNT	4435-103
	W1	SILICONE WHITE #22 HV	21-8543
	W4	SILICONE BLACK #22 GND	21-8552

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## **Drawings and Diagrams**

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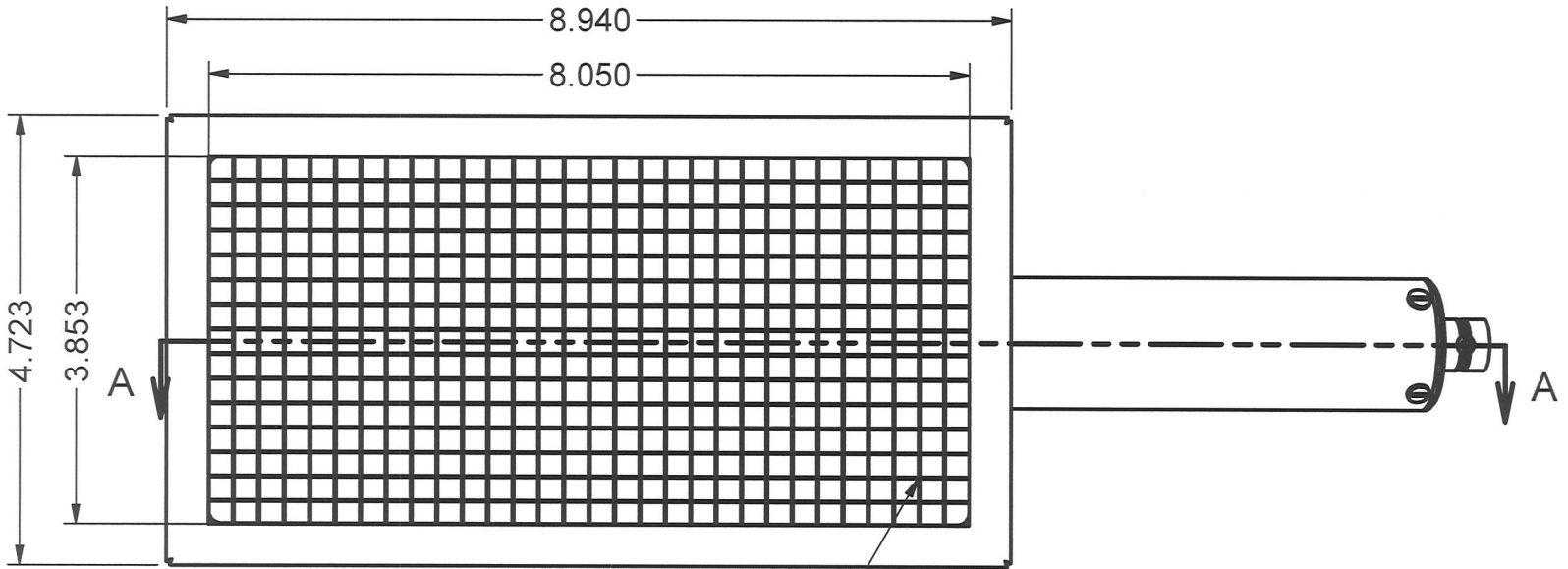
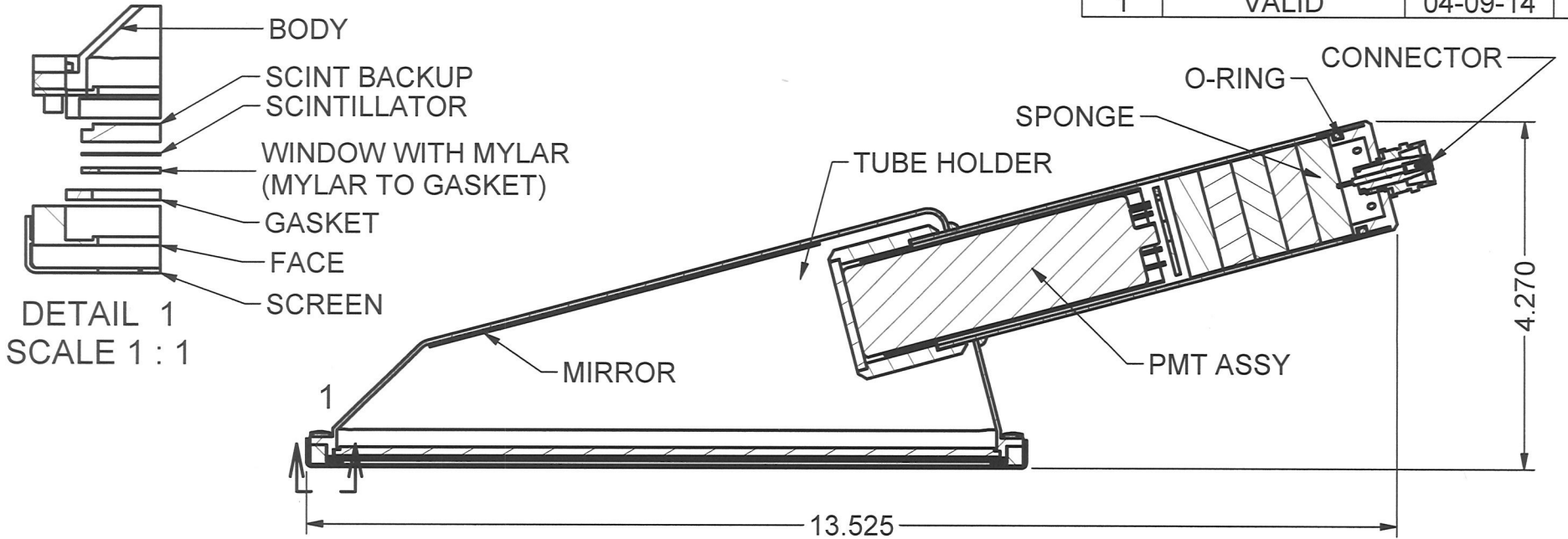
Model 43-147 Assembly View, Drawing 393 × 288

Model 43-147 Mylar Window, Drawing 393 x 288A

1 1/8 inch Voltage Divider Circuit Board, Drawing 435 × 1700

1 1/8 inch Voltage Divider Component Layout, Drawing 435 × 1701  
(2 sheets)

REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	04-09-14	SM



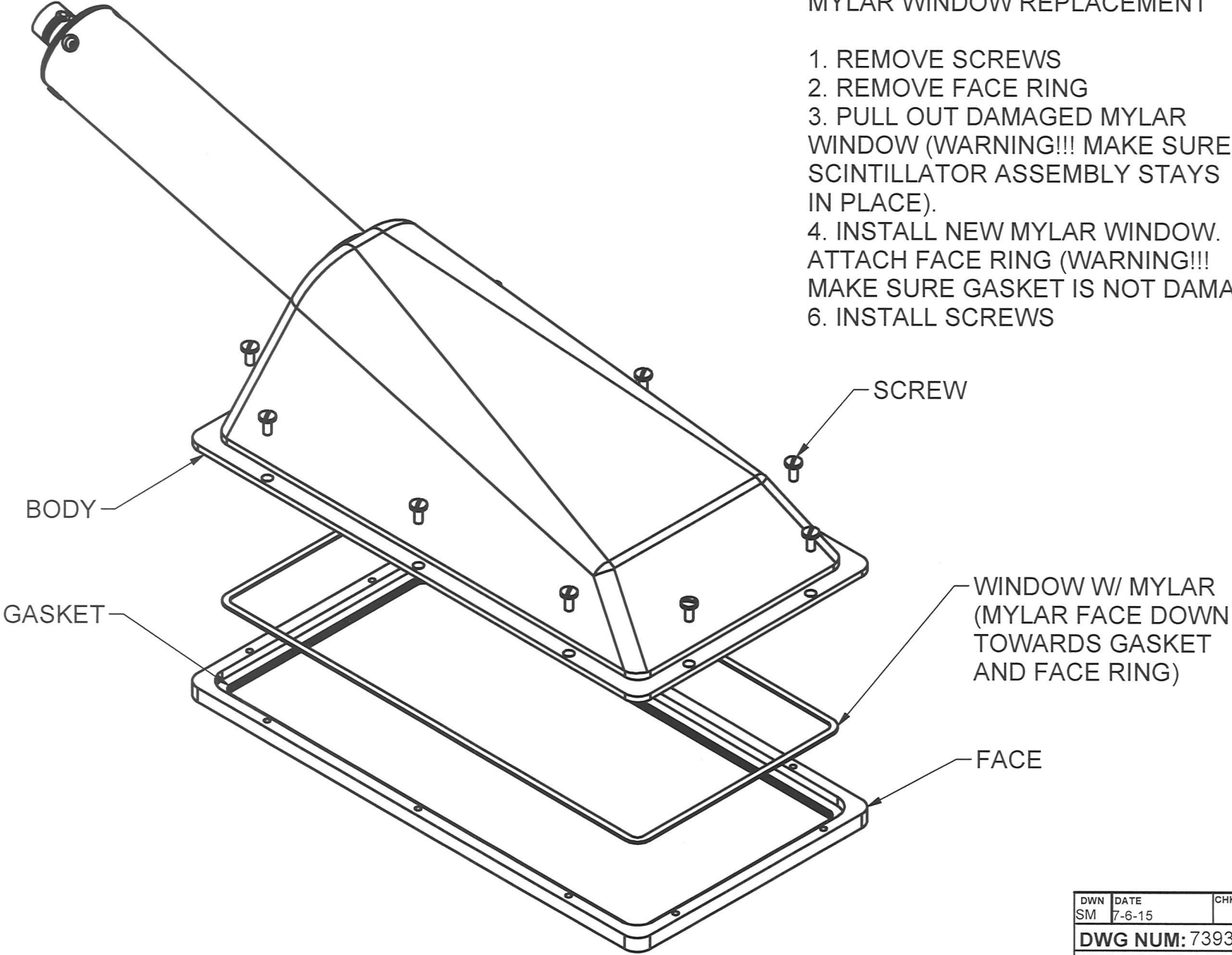
88% OPEN AREA

DWN	DATE	CHK	DATE	APP	DATE
SM	4-10-2014			J6w	4-10-14
<b>DWG NUM: 4393-288</b>				SCALE: 1	
<b>TITLE M 43-147 OVERALL DIMENSIONS</b>					
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556			SERIES 393	SHEET 288	

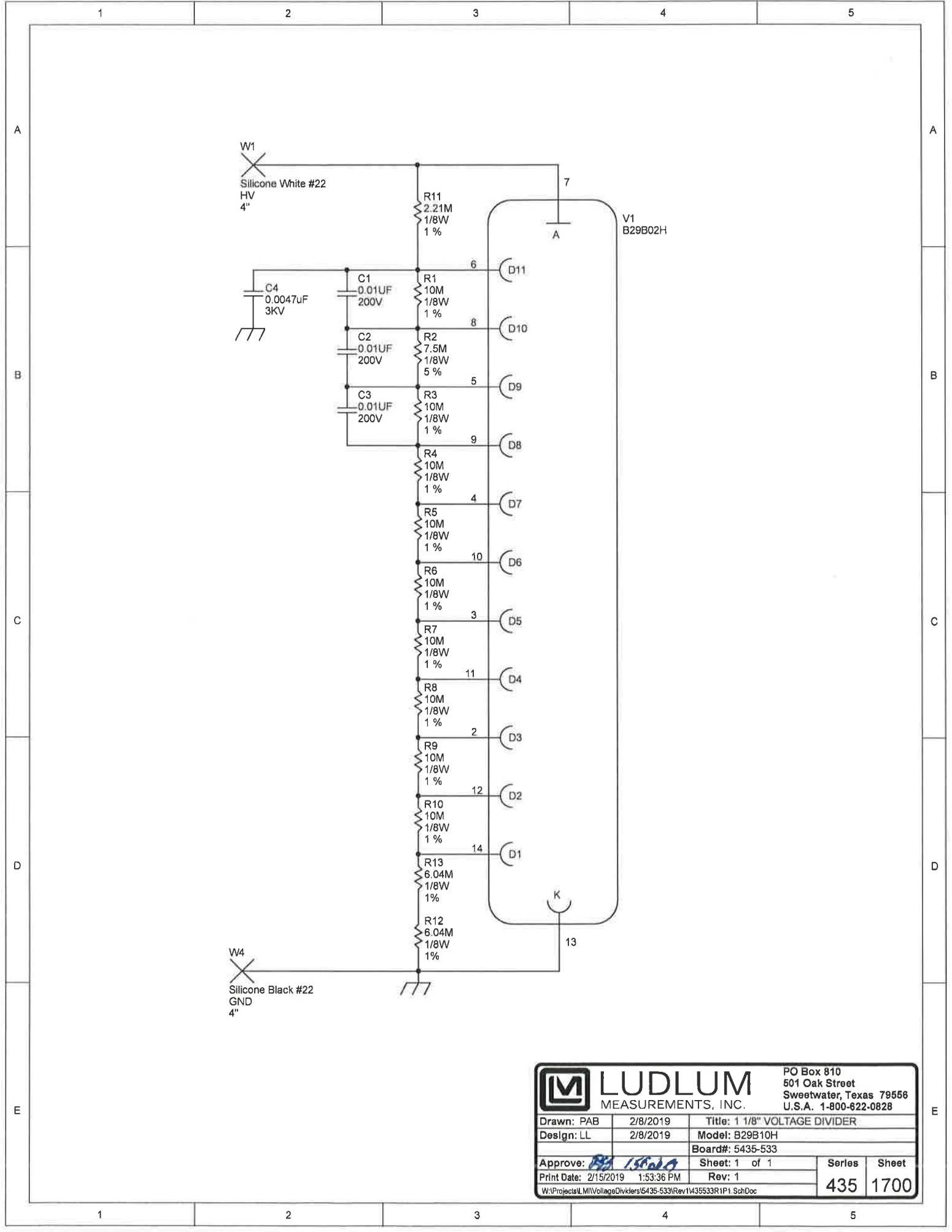
REVISION HISTORY			
REV	DESIGNATION	DATE	APPROVED
1	VALID	7-6-15	SM

MYLAR WINDOW REPLACEMENT

1. REMOVE SCREWS
2. REMOVE FACE RING
3. PULL OUT DAMAGED MYLAR WINDOW (WARNING!!! MAKE SURE SCINTILLATOR ASSEMBLY STAYS IN PLACE).
4. INSTALL NEW MYLAR WINDOW. ATTACH FACE RING (WARNING!!! MAKE SURE GASKET IS NOT DAMAGED)
6. INSTALL SCREWS



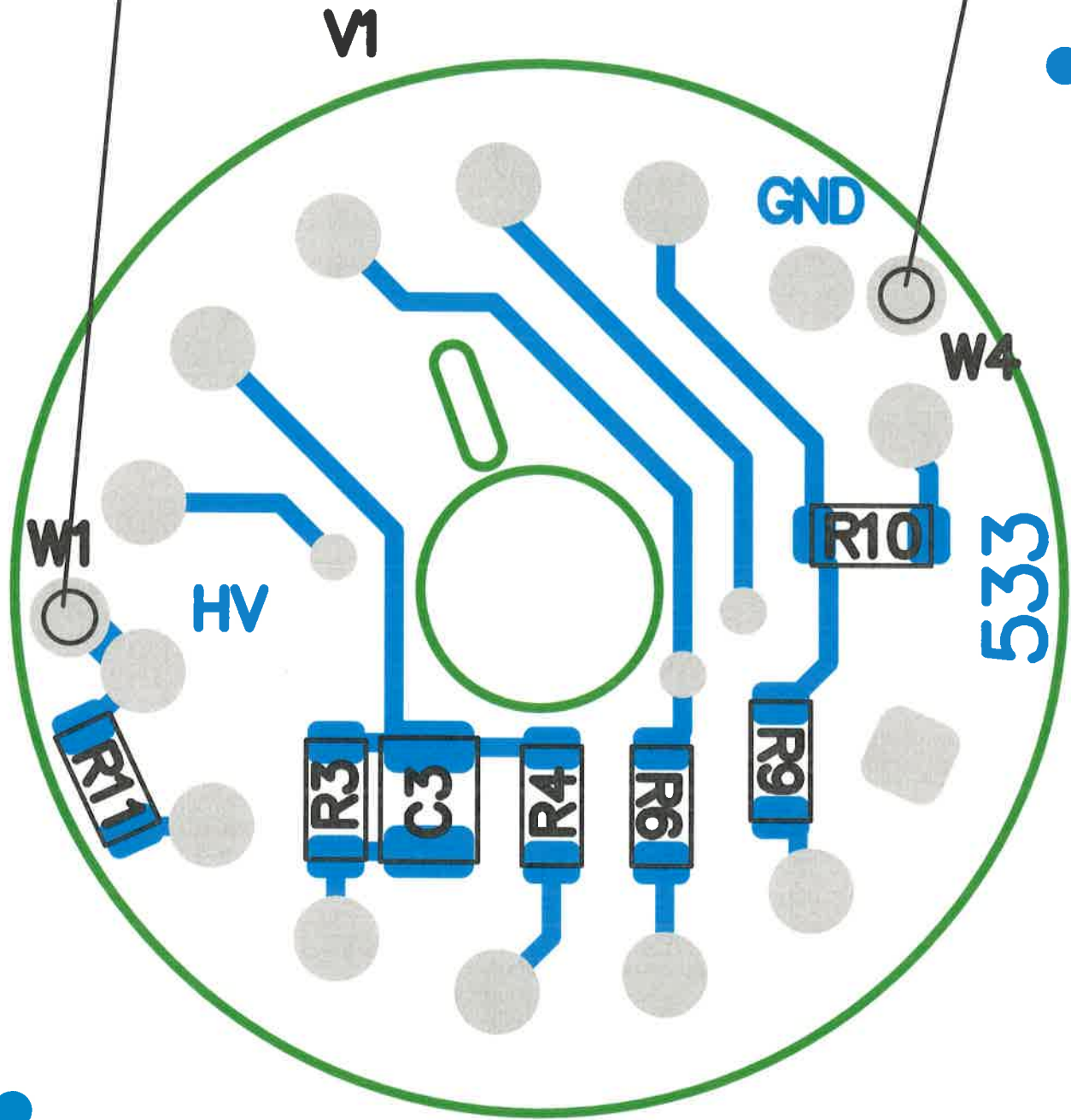
DWN SM	DATE 7-6-15	CHK	DATE	APP RSS	DATE 6/5/15
DWG NUM: 7393-288A				SCALE: 1 : 2	
TITLE M 43-147 MYLAR WINDOW					
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556			SERIES 393	SHEET 288A	



		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
		Drawn: PAB Design: LL Approve: <i>[Signature]</i> Print Date: 2/15/2019 1:53:36 PM	2/8/2019 2/8/2019 1:53:36 PM
<small>W:\Projects\LM\VoltageDividers\5435-533\Rev1\435533R1P1 SchDoc</small>			

4" WHITE SILICONE WIRE

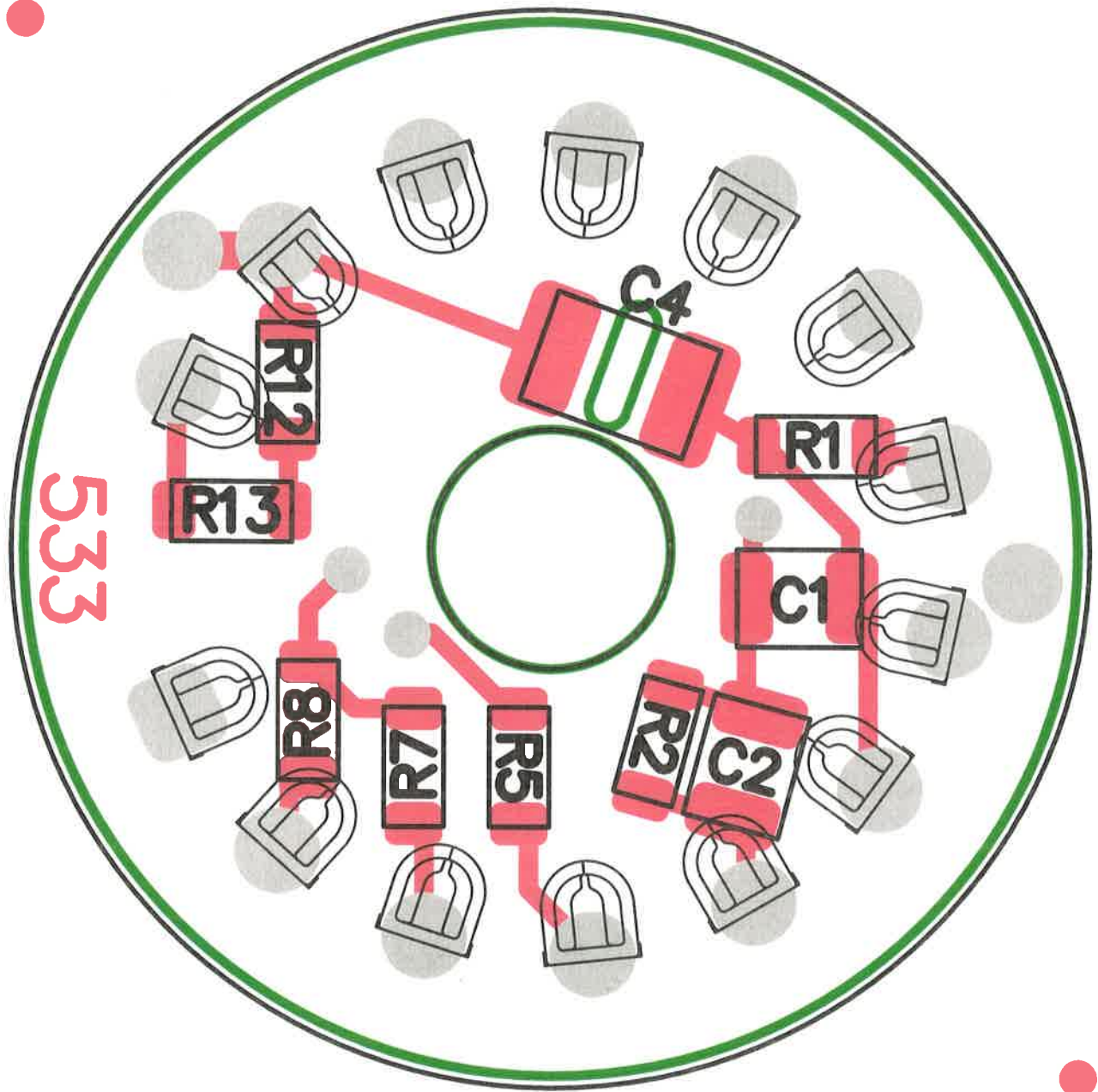
4" BLACK SILICONE WIRE



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

<b>Title:</b> 1 1/8" VOLTAGE DIVIDER			
<b>Drawn:</b> PAB	2/8/2019	<b>Model:</b> B29B10H	
<b>Design:</b> LL	2/8/2019	<b>Board#:</b> 5435-533	
<b>Approve:</b> <i>LL</i>	<i>2/8/19</i>	<b>Rev:</b> 3	
<b>PCBA Drawing</b>		<b>SCALE:</b> 1.08	<b>Series</b> Sheet
<b>Print Date:</b> 2/15/2019 1:55:41 PM		Top Overlay	435 1701

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

**Title:** 1 1/8" VOLTAGE DIVIDER

<b>Drawn:</b> PAB	2/8/2019	<b>Model:</b> B29B10H
<b>Design:</b> LL	2/8/2019	<b>Board#:</b> 5435-533
<b>Approve:</b> <i>RL</i>	<i>15 Feb 19</i>	<b>Rev:</b> 3
<b>PCBA Drawing</b>		<b>SCALE:</b> 1.08
<b>Print Date:</b> 2/15/2019 1:55:46 PM	<b>Bottom Overlay</b>	<b>Series</b> 435 <b>Sheet</b> 1701

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