

**LUDLUM MODEL 43-78-2  
ALPHA-BETA SAMPLE COUNTER**

**SERIAL NUMBER PR162230  
AND SUCCEEDING SERIAL NUMBERS**

**February 2016**

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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**



# Model 43-78-2 Alpha-Beta Sample Counter

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# Model 43-78-2 Alpha-Beta Sample Counter

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## 1. GENERAL

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The Model 43-78-2 is a lead-shielded alpha-beta sample holder used for counting filters. The Sample Holder can be used with the Model 2929, any of the Ludlum dual-channel scaler instruments capable of alpha-beta counting, or other equivalent counting

instruments.

The scintillator material is adhered to the light pipe.

## 2. OPERATION

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- Connect the Model 43-78-2 to the scaler. The coax cable with "C" connectors carries both the signal and HV.
- HV is applied to the Photomultiplier Tube (PMT) when the sample slide is pushed completely in and the Open/Close knob is rotated to the CLOSED position.
- Select appropriate count time and record background counts. Normal background activity is expected to be approximately 7 counts per 10 minutes for the alpha channel and less than or equal to 100 cpm (counts per minute) for the beta channel at the proper operating voltage.
- For counting samples of potentially radioactive material, place the sample in the sample depression. Do not allow the sample material to extend above the top of the sample slide. Place sample slide in locked position for a short time before taking count to allow room light to decay out of the scintillation material.
- A background count should be taken after each source count to check for contamination on the sample holder or area within the O-ring.

## 3. SPECIFICATIONS

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### Scaler Input Sensitivity:

Alpha Channel: 175 mV

Beta Channel: 4 mV

Beta Window: 50 mV

**Photomultiplier Tube:** 7.6 cm (3 in.) diameter, 14 pin tube base, 10 pin dynode structure

**Scintillator Material:** ZnS(Ag) for alpha particle detection; EJ212 for detection of beta particles

**Sample Size:** (maximum) 7.6 x 0.46 cm (3 x 0.18 in.) (Dia x L)

**HV Switch:** turning knob to OPEN position

**Window:** 0.4 mg/cm<sup>2</sup>

**Efficiency (4 pi):** 37% for <sup>239</sup>Pu; 37% for <sup>90</sup>Sr/<sup>90</sup>Y

**Background:** Alpha: 7 counts per 10 minutes; Beta: 100 cpm or less

**Sample Holder:** anodized aluminum tray

**Weight:** 32 kg (70 lb)

**Size:** 15.2 x 29 cm (6.0 x 11.4 in.) (Dia x L)

# Model 43-78-2 Alpha-Beta Sample Counter

## 4. CALIBRATION PROCEDURE

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### 4.1 Counting Instrument

- Calibrated dual-channel scaler instrument
- HV Range – Nominally 800-1200 volts
- Input Sensitivity – 4 mV beta channel; 175 mV alpha channel; 50 mV beta window
- Model 43-78-2 instrument should be dark adapted; slide closed lock a minimum of 2 hours after assembly, before taking data.

### 4.2 Procedure

#### Background Check

- Connect Model 43-78-2 to counting instrument with proper cable.
- Push sample drawer in and lock.
- Record background count starting at 800 volts with 25-volt increments. Increase voltage until background count exceeds 3 cpm for the alpha channel or 100 cpm for the beta channel. Do not exceed 1500 volts.

#### Source Plateau

- Place check source (alpha or beta) in sample drawer. Close and lock. Raise source from bottom of sample drawer if thickness of source permits for better counting geometry.

- Record sample count starting at 800 volts with 25-volt increments. Increase voltage to maximum background voltage, determined in above step. Record crosstalk.
- Set HV just above knee of plateau. Background count should be less than 7 counts per 10 minutes in the alpha channel and 100 cpm in the beta channel at that operating point. In addition, the channel crosstalk (alpha counts in beta channel and beta counts in alpha channel) should correspond to the following:
  - Alpha in beta channel: #10% of gross counts
  - Beta in alpha channel: #1% of gross counts

#### Calculating Efficiency

- Calibrated check source required.
- Source may be in cpm, dpm or microcuries.
- Set the HV as determined in the Source Plateau section.
- Place calibrated source in the sample drawer and close it.
- Record the source count
- Divide the source count by the value of the source.

# Model 43-78-2 Alpha-Beta Sample Counter

## 5. TROUBLE SHOOTING

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### 5.1 Zero or Very Low Counts

- Large light leak
- PMT malfunction
- Broken wire in tube socket
- Inoperative HV switch on Model 43-78-2 or broken wire
- Counting instrument malfunction
- Cable malfunction
- Alpha source too far from scintillation material
- ZnS brushed off or too thin

### 5.2 No Source Plateau

- Light leak, slide not sealed properly against true base
- Noisy PMT
- Noisy HV switch
- Poor PMT scintillation light pipe interface

### 5.3 Excessive Background Count

- Light leak
- PMT malfunction
- Cable malfunction
- Noisy HV switch
- Instrument contaminated

## Model 43-78-2 Alpha-Beta Sample Counter

### REPLACEMENT PARTS LIST

Qty.	Description	Part No.
<b>Model 43-78-2 Alpha-Beta Sample Counter</b>		
UNIT	Completely Assembled Model 43-78-2 Alpha-Beta Sample Counter	47-2620
1 ea.	2 inch Tube Socket Board	5002-934
4 ea.	Sponge	7142-170
1 ea.	Sponge	7142-171
1 ea.	Bracket	7142-165
1 ea.	Tray	7142-157
1 ea.	Slide	7142-167
1 ea.	Plate	7142-161
1 ea.	Holder	7142-159
1 ea.	Pin	7142-160
1 ea.	Lifter	7142-155
1 ea.	Plexiglass	7142-183
1 ea.	3 inch PM -B76B01S	01-5017
*	Foil-Netic	01-5019
*	Foil-Co-Netic	01-5026
1 ea.	EJ212 3.250 x 0.010	01-5648
1 ea.	Switch BZ-2RD-A2	08-6538
1 ea.	PKG-50B-1/8	08-6601
1 ea.	904 2G Pointer	08-6608
1 ea.	CONN-UG568/U	13-7752
1 ea.	O-Ring	16-8344

### Switch Filter Board, Drawing 142 x 58

#### BOARD

Assembled Switch Filter 5142-103

#### CAPACITORS

C1-C2 0.0056 $\mu$ F, 3 KV 04-5522

C3 0.0015 $\mu$ F, 3 KV 04-5518

#### RESISTORS

R1-R2 1 M, 1/4W, 5% 10-7028

#### MISCELLANEOUS

\* CLVRLF-011-6809-000-599  
18-8771

\* CONTACT-#1434  
18-9124

### Tube Socket Board, Drawing 2 x 934

BOARD Completely Assembled  
2 inch Tube Socket 5002-934

#### CAPACITORS

C1 0.01 $\mu$ F, 2kV 04-5722

#### RESISTORS

R1-R13 4.75 M, 1/4W, 1% 12-7995

## Model 43-78-2 Alpha-Beta Sample Counter

### **DRAWINGS AND DIAGRAMS**

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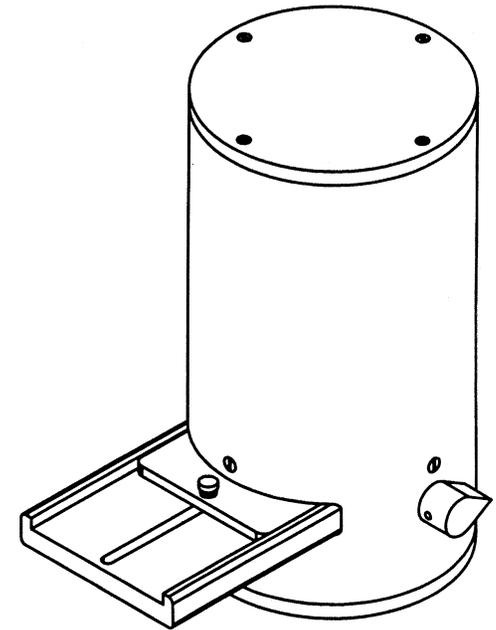
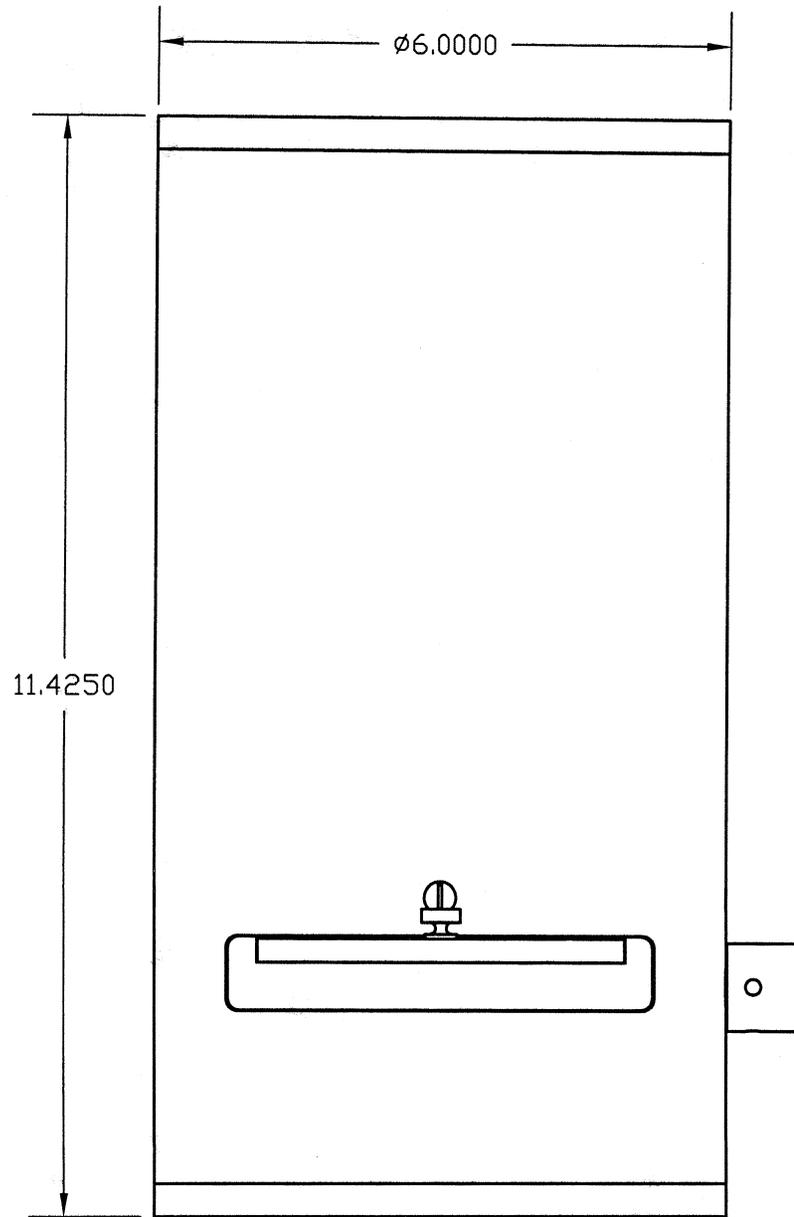
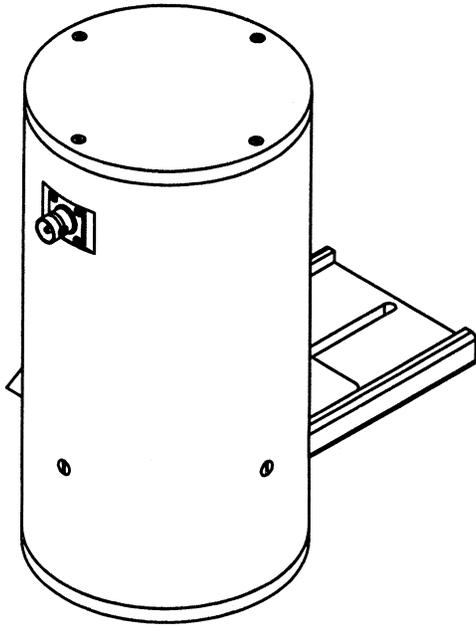
Assembly, Drawings 142 x 168 & 168A

Switch Filter Board, Drawing 142 x 58

Switch Filter Board Component Layout, Drawing 142 x 59

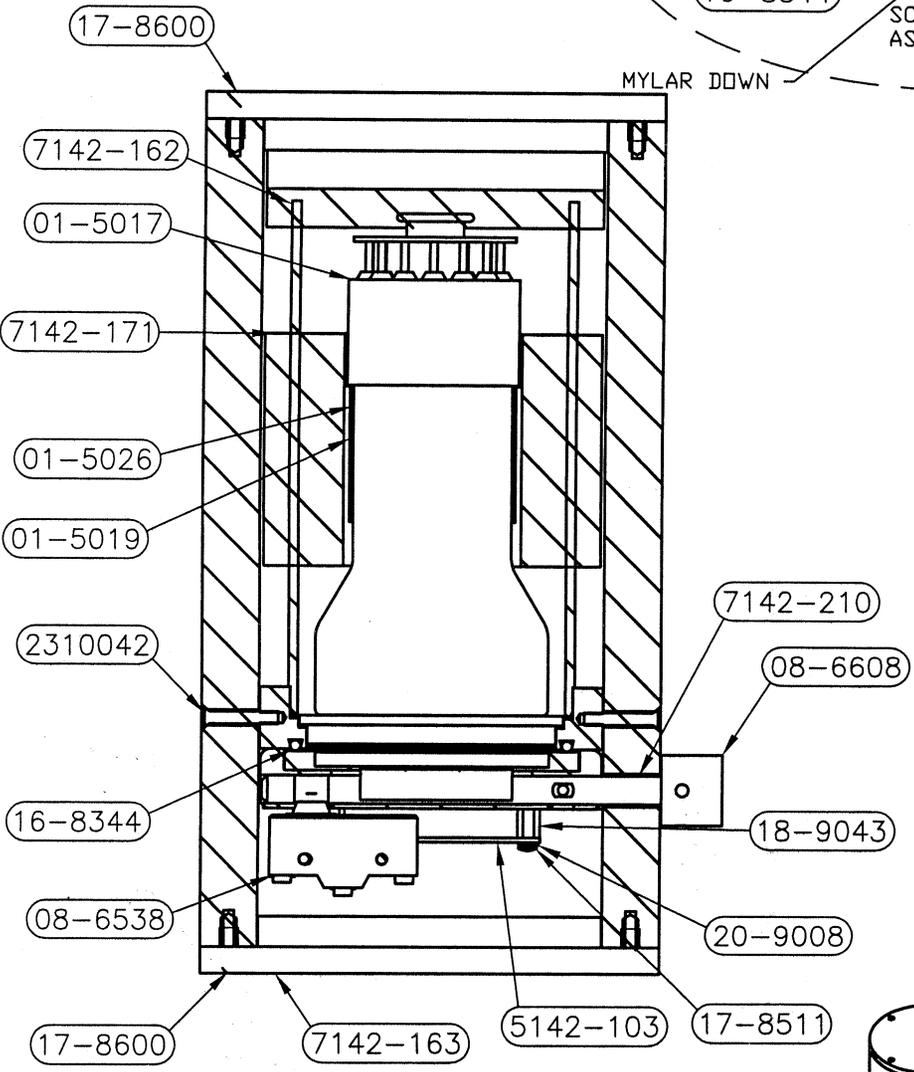
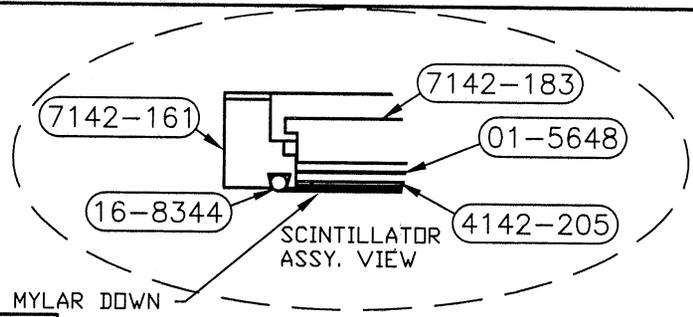
Tube Socket Board Schematic, Drawing 2 x 934

REV #	ALTERATIONS	DATE	BY
3	SEE BOM	6/01/00	TJR
4	ECF # 1072	12/20/01	DSW

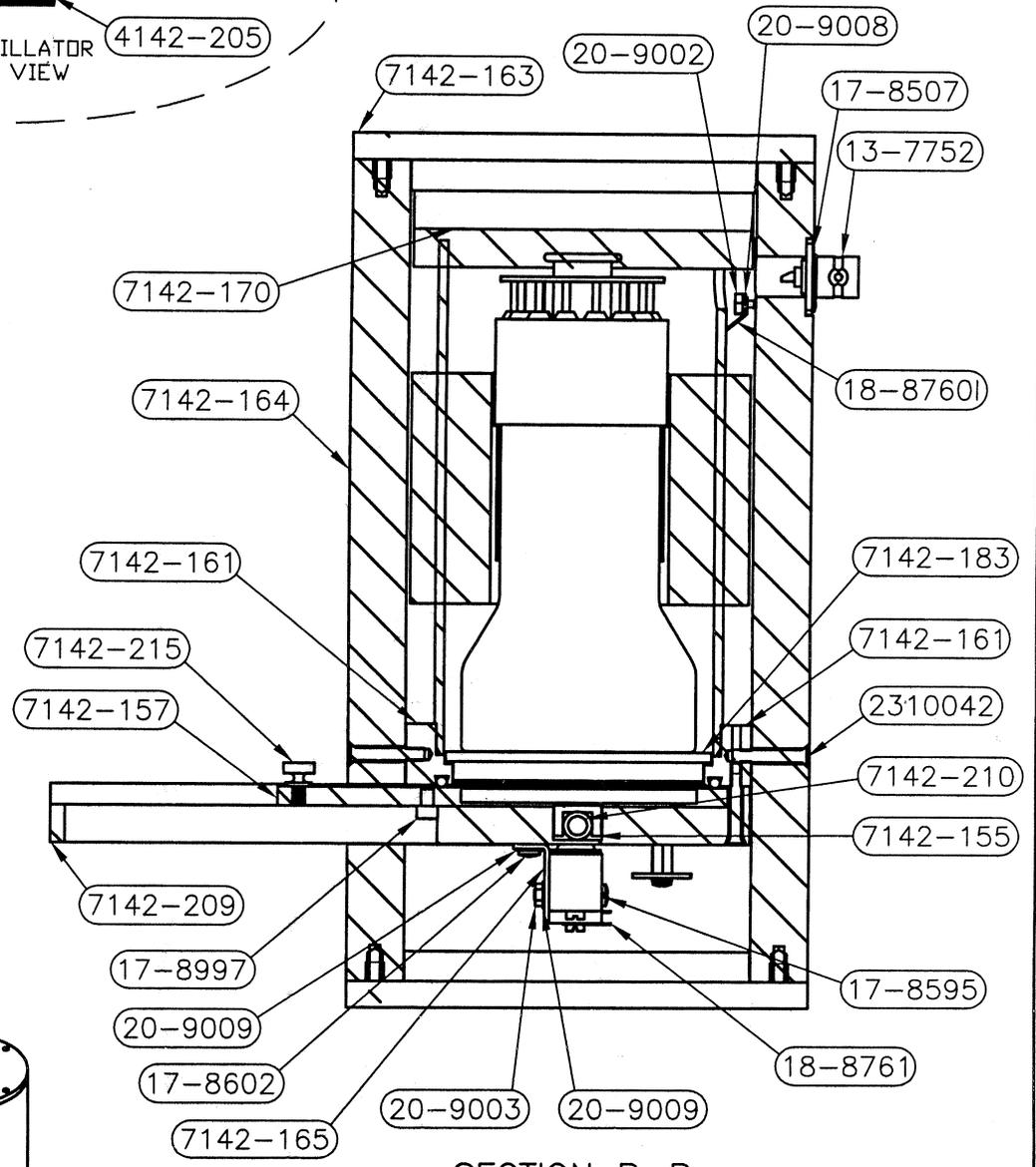


DWN	DATE	CHECKED	APPROVED
DSW	12/20/01	DSW 12-21-01	DSW 12-27-01
TITLE M 43-78-2 ASSEMBLY INSTRUCTIONS			
 LUDLUM MEASUREMENTS, INC. 591 DMK STREET SUGGETT, TEXAS 75556		SERIES	SHEET
		142	168

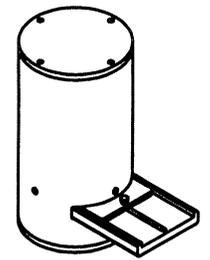
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3	SEE BOM	6/01/00	TJR
4	ECF # 1072	12/20/01	DSW



SECTION C-C

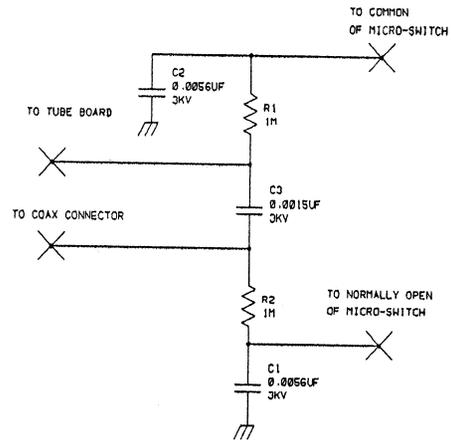


SECTION B-B

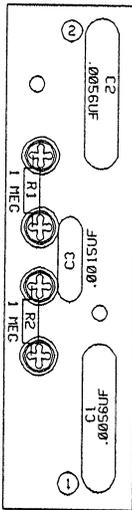


DWN	DATE	CHECKED	APPROVED
DSW	12/20/01	<i>[Signature]</i> 12-27-01	<i>[Signature]</i> 12-27-01
TITLE: M 43-78-2 ASSY.			
LUDLUM MEASUREMENTS, INC. 301 OAK STREET FORTWORTH, TEXAS 76106		SERIES 142	SHEET 168A

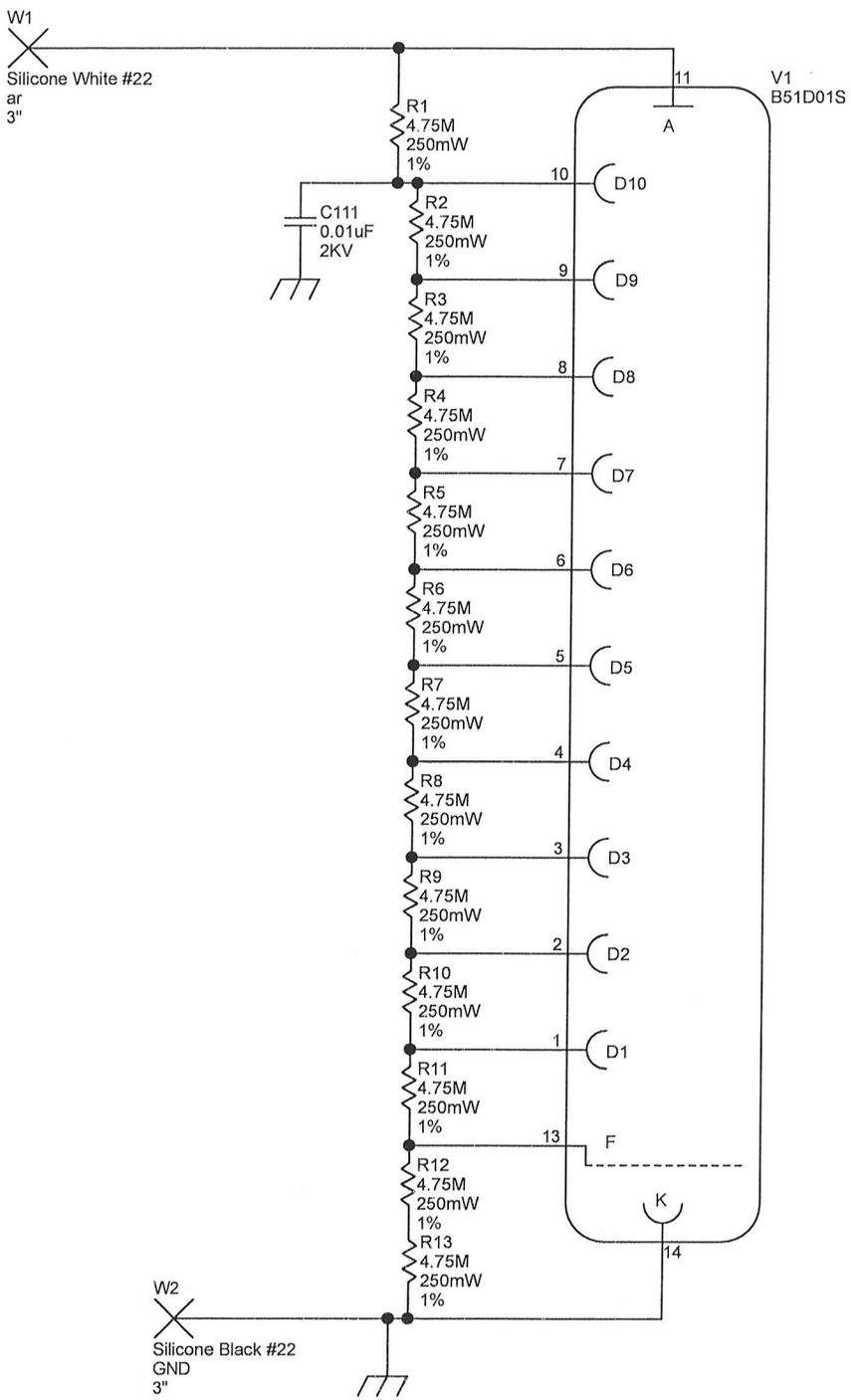
				REVISIONS		
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED



UPDATED	-	LUDLUM MEASUREMENTS INC.			
DR PW	10/20/92	TITLE: SWITCH			
CHK	CKB 07-JAN-93	FILTER BOARD			
DSCN PW	10/20/92	BOARD# S142-103			
APPD	BS 11-6-01	SIZE	MODEL	SERIES	SHEET
NEXT HIGHER ASSY.	-	C	43-10	142	58
09:36:53	27-Jan-93	S8142103		SHEET	OF 1



<input checked="" type="checkbox"/> LUDLUM MEASUREMENTS INC. SHEETWATER, TX.			
DR	PW	10/20/92	TITLE: SWITCH
CHK	CKB	27-28-99	FILTER BOARD
DSCN	PW	10/20/92	BOARD# 5142-103
APP	CKB	1-27-99	MODEL 43-10
			SERIES 142
			SHEET 59
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		COMP PASTE <input type="checkbox"/>	COMP MASK <input type="checkbox"/>
		SLDR PASTE <input type="checkbox"/>	SLDR MASK <input type="checkbox"/>



		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
		Drawn: RC Design: PAB Approved: <i>RIS 12/20/15</i> Print Date: 11/3/2015 10:52:05 AM	Title: 2" VOLTAGE DIVIDER Model: N/A Board#: 5002-934 Sheet: 1 of 1 Rev: 3

W:\Projects\LMV\VoltageDividers\5002-934\Rev3\002934R3P1\_SchDoc