

**LUDLUM MODEL 44-157 &
44-159 & 44-159-1 & 44-162
GAMMA PIPE MONITORS**

June 2021

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Introduction

The series of scintillator gamma pipe monitors (Models 44-157, 44-159, 44-159-1 and 44-162) is primarily used for detecting low levels of gamma radiation in the range of 60 keV–1.25 MeV.

The Model 44-157 consists of a 2 x 2 inch NaI crystal coupled to a photomultiplier tube housed in aluminum. The Model 44-159 and 44-159-1 consist of an 18 x 18 mm CsI crystal, and the Model 44-162, a 3 x 3 inch NaI crystal, both also coupled to a photomultiplier tube housed in aluminum.

The detector is energy dependent, typically over-responding in the 100 keV range and under-responding above 1 MeV when normalized to ¹³⁷Cs.

The gamma pipe monitors will operate with any Ludlum instruments or equivalent instruments that provide 700–1200 volts. The recommended instrument input sensitivity is approximately 10 mV or higher.

Some common applications for this detector include background radiation monitoring, low-level radiation detection, and spectrum analysis when used in conjunction with a single- or multi-channel analyzer.



Model 44-159-1

Note:

If the detector is used in a manner not intended by the manufacturer, the detector may not function properly.

Note:

The detector does not contain any consumable materials.

Unpacking and Repacking

Remove the calibration certificate or detector functional check certificate and place it in a secure location. Remove the detector(s) and accessories (if applicable) and ensure that all items listed on the packing list are in the carton. If multiple detectors are included, refer to the calibration certificates for serial number (SN) matches.

To return an instrument or detector for repair or calibration, provide sufficient packing material to prevent damage during shipment, and affix appropriate warning labels to promote careful handling.

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

Specifications

Scintillator: 44-157: 5.1 x 5.1 cm (2 x 2 in.) (Dia x thickness), NaI (Tl) crystal
44-159 & 44-159-1: 18 x 18 mm (0.7 x 0.7 in.) CsI (Tl) crystal
44-162: 7.6 x 7.6 cm (3 x 3 in.) NaI (Tl) crystal

Compatible Instruments: general-purpose survey meters, ratemeters and scalers

Sensitivity: 44-157: 900 cpm/ μ R/hr (^{137}Cs gamma)
44-159 & 44-159-1: 120 cpm/ μ R/hr
44-162: 2300 cpm/ μ R/hr

Energy Range: 44-157: 60 keV to 3 MeV
44-159 & 44-159-1: 50 keV to 3 MeV
44-162: 60 keV to 3 MeV

Background: 44-157: 9750 cpm
44-159 & 44-159-1: 750 cpm
44-162: 2200 cpm

Operating Voltage: 44-157: 500-1200 Vdc
44-159 & 44-159-1: 700-1200 Vdc
44-162: 500-1200 Vdc

Dynode String Resistance: 44-157: 60 megohm
44-159 & 44-159-1: 100 megohm
44-162: 60 megohm

Efficiency: 44-157: ^{57}Co is 11%; ^{137}Cs is 5%; and ^{60}Co is 10%
44-159 & 44-159-1: ^{57}Co is 14%; ^{137}Cs is 3%; and ^{60}Co is 5%
44-162: ^{125}I is 29%

Model 44-157, 44-159, 44-159-1, 44-162
Gamma Pipe Monitors

Connector: BNC (others available)

Tube: magnetically shielded photomultiplier

44-157 diameter: 16 mm (0.63 in.)

44-159 & 44-159-1 diameter: 16 mm (0.63 in.)

44-162 diameter: 2.9 cm (1.3 in.)

Construction: aluminum housing with beige powder-coat finish

Temperature Range: -20 to 50 °C (-4 to 122 °F); may be certified for -40 to 65 °C (-40 to 150 °F)

Size:

44-157: 8.9 x 15.5 cm (3.5 x 6.1 in.) (Dia x L)

44-159: 2.5 x 7.1 cm (1 x 2.8 in.) (Dia x L)

44-159-1: 2.2 x 8.1 cm (0.875 x 3.2 in.) (Dia x L)

44-162: 19.1 x 24.1 cm (7.5 x 9.5 in.) (Dia x L)

Weight:

44-157: 1.4 kg (3 lb)

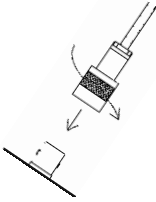
44-159: 0.1 kg (0.3 lb)

44-159-1: 0.1 kg (0.3 lb)

44-162: 2.3 kg (5 lb)

Operating Procedures

CONNECTING TO AN INSTRUMENT



Connect one end of the cable provided to the detector by firmly pushing the connector together while twisting clockwise one quarter of a turn until latched. Repeat the process in the same manner with the other end of the cable and the instrument.

TESTING THE DETECTOR

1. Ensure the instrument high voltage (HV) is at the proper setting for the detector.
2. Connect the detector to the instrument and check for a proper background.
3. Expose the detector to a check source and verify that the instrument indicates within 20% of the check source reading from the last calibration. Alternatively, expose the detector to a source of known value and verify that the detector detects greater than or equal to the efficiency listed in the specification section of this manual.
4. Instruments and detectors that meet these criteria are ready for use. Failure to meet these criteria may indicate a malfunction in the detector.

Safety Considerations

ENVIRONMENTAL CONDITIONS FOR NORMAL USE

1. Indoor or outdoor use (in a dry environment)
2. No maximum altitude
3. Temperature range of -20 to 50 °C (5 to 122 °F); May be certified for operation from -40 to 65 °C (-40 to 150 °F).
4. Maximum relative humidity of less than 95% (non-condensing)
5. Pollution Degree 3 (as defined by IEC 664)

(Occurs when conductive pollution or dry nonconductive pollution becomes conductive due to condensation. This is typical of industrial or construction sites.)

CLEANING INSTRUCTIONS AND PRECAUTIONS

The detector may be cleaned externally with a damp cloth, using only water as the wetting agent. Do not immerse the instrument in any liquid. Observe the following precautions when cleaning:

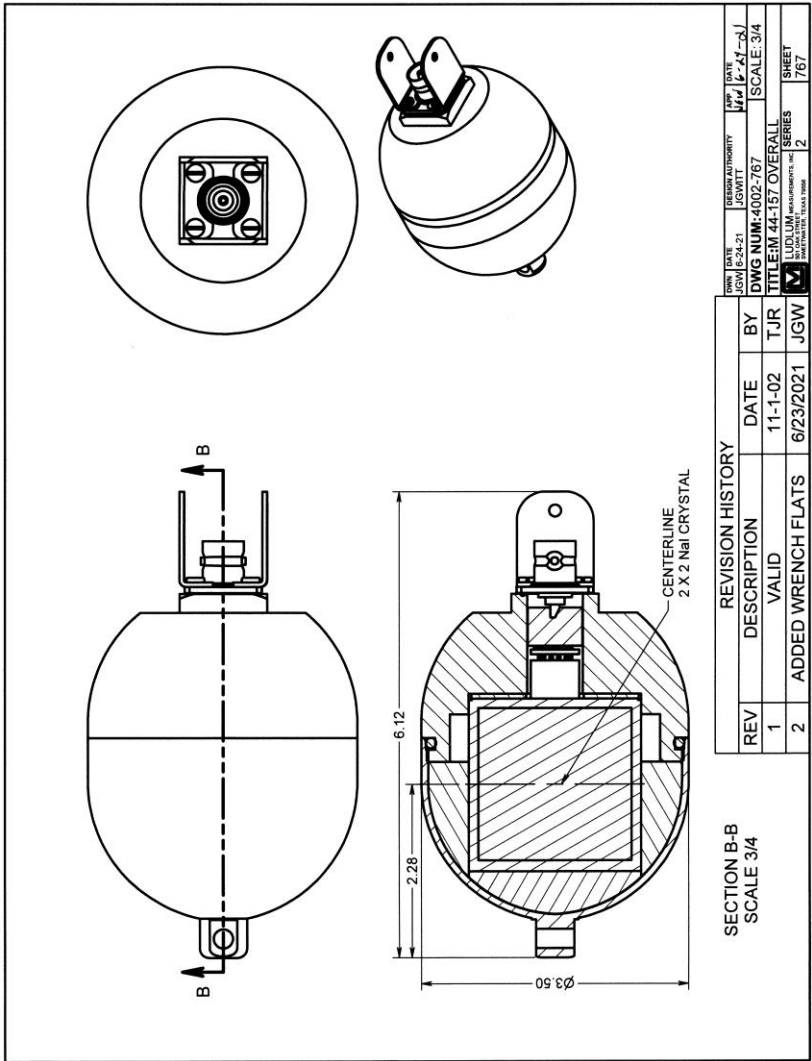
1. Turn the instrument electronics OFF.
2. Allow the instrument to sit for one minute.
3. Disconnect the detector cable before cleaning the detector.

Parts List, Drawings and Diagrams

Model 44-157 Gamma Pipe Monitor

<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
UNIT	Completely Assembled Model 44-157 2X2 SPHERICAL Gamma Pipe	47-3332
1 EA	DETECTOR BODY TOP	7002-773
1 EA	DETECTOR BODY BOTTOM	7002-774
1 EA	GROUND PLATE	7002-775
1 EA	REFLECTIVE RING	7002-776
2 EA	CONN PULL 2	7002-781
3 EA	FOAM RING	7090-015
1 EA	FOAM PAD	7260-001-05
1 EA	2 x 2 in. NaI CRYSTAL	01-5128
1 EA	PM TUBE-R9880U/110	01-5936
1 EA	RECPT-UG568/U PANEL C FLANGE	13-7752
1 EA	O-RING 2-235 BUNA 70	16-8388
4 EA	SCREW 4-40 X 5/16 BH	17-8511
4 EA	WIRE-TEFLON WHITE EE24	21-9362
4 EA	WIRE-#24 BLACK	21-9558

Model 44-157, 44-159, 44-159-1, 44-162
Gamma Pipe Monitors

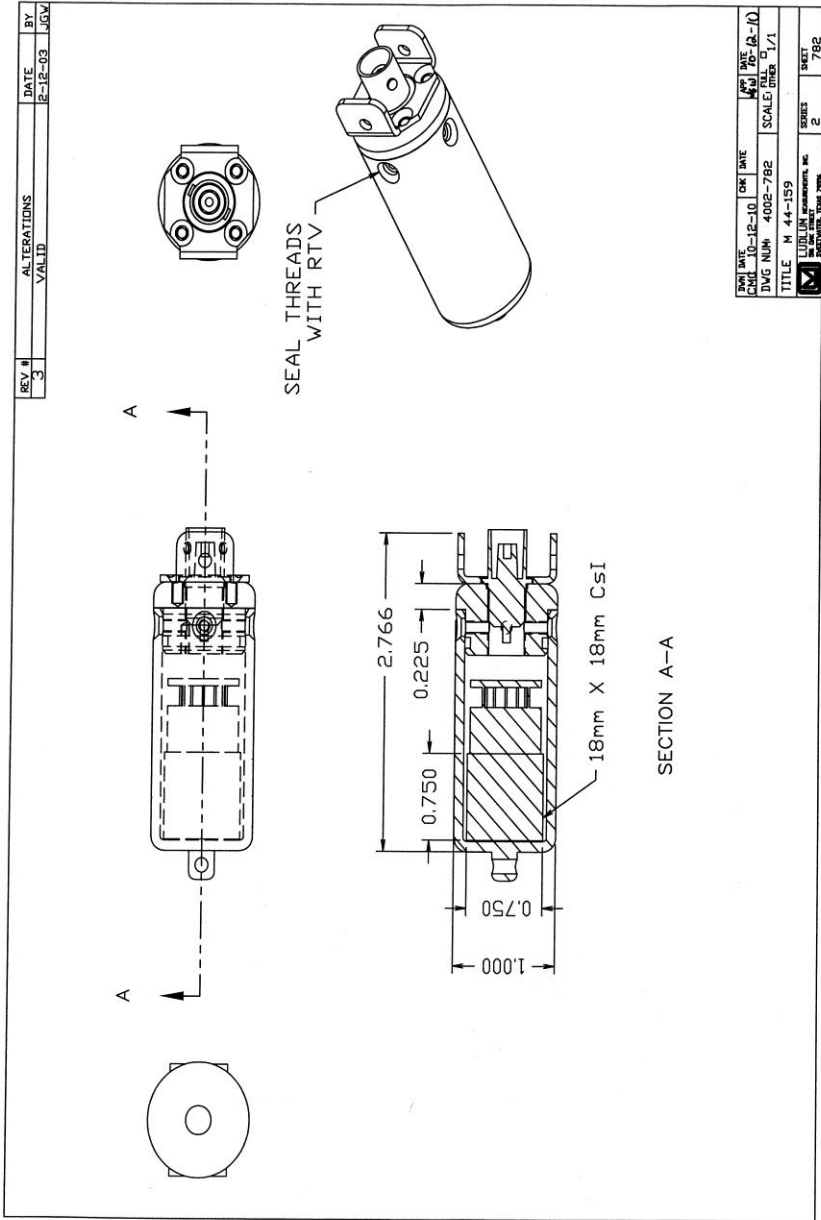


*Model 44-157, 44-159, 44-159-1, 44-162
Gamma Pipe Monitors*

Model 44-159 Gamma Pipe Monitor

<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
UNIT	Completely Assembled Model 44-159 18 X 18 mm Csl Pipe	47-3346
1 EA	DETECTOR BODY TOP	7002-783
1 EA	DETECTOR BODY BOTTOM	7002-784
1 EA	REFLECTIVE RING	7002-785
1 EA	CONN PULL 2	7002-786
1 EA	SPONGE 4-P BS	7002-065-04
1 EA	18 X 18 mm Csl (TL) CRYSTAL	01-5661
1 EA	PM TUBE-R9880U/110	01-5936
1 EA	RECPT-UG1094/U SCREW BNC	13-7753
1 EA	O-RING-2-017	16-8304
4 EA	SCREW 4-40 X 3/16 BH	17-8509
1 EA	SCREW 2-56 X 1/8 BH	17-8727
4 EA	SCREW 4-40 X 3/16 FH	17-8811
1 EA	LUG #2 922-092	18-9034
2 EA	WIRE-TEFLON WHITE #22 HV	21-8543
2 EA	WIRE-#26 BLACK 0 UL1429	21-9432

Model 44-157, 44-159, 44-159-1, 44-162 Gamma Pipe Monitors



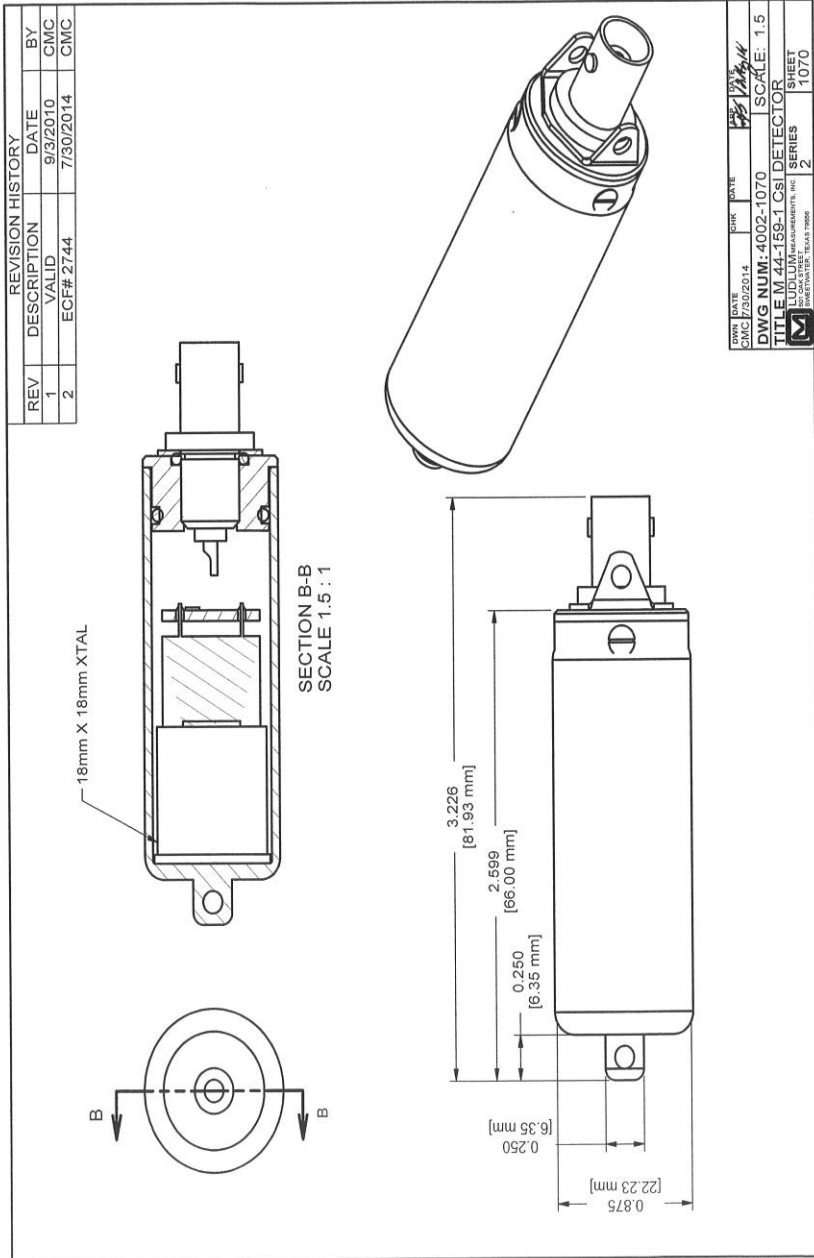
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LUDLUM MEASUREMENTS, INC.		
800 WILSON ROAD, 798		
SERIES: 2	SHEET: 782	

Model 44-157, 44-159, 44-159-1, 44-162
Gamma Pipe Monitors

Model 44-159-1 Gamma Pipe Monitor

<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
UNIT	Completely Assembled Model 44-159-1 18 X 18 mm Csl Pipe	47-3820
1 EA	DETECTOR BODY TOP	7002-1071
1 EA	DETECTOR BODY BOTTOM	7002-1072
1 EA	CONN PULL BRACKET	7002-1073
1 EA	SPRING END CUSHION	7002-998
1 EA	SPONGE 4-P BS	7002-065-04
1 EA	18 X 18 mm Csl (TL) CRYSTAL	01-5661
1 EA	PM TUBE-R9880U/110	01-5936
1 EA	RECPT-UG657A SCREW BNC	13-8012
1 EA	O-RING-2-012	16-8302
1 EA	O-RING-2-106 BUNA 17	16-8364
1 EA	SCREW 2-56 X 1/8 BH	17-8727
3 EA	SCREW 2-56 X 1/8 FH	17-8743
1 EA	LUG #2 922-092	18-9034
2 EA	WIRE-TEFLON WHITE #22 HV	21-8543
2 EA	WIRE-#26 BLACK 0 UL1429	21-9432

Model 44-157, 44-159, 44-159-1, 44-162 Gamma Pipe Monitors

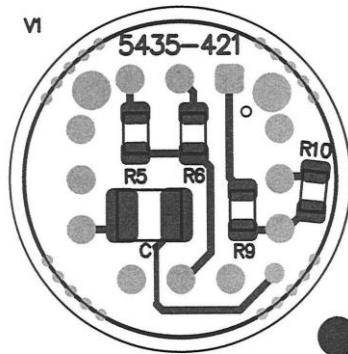
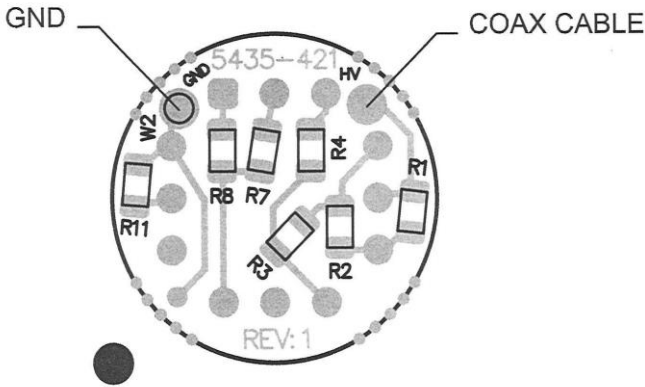


Model 44-157, 44-159, 44-159-1, 44-162
Gamma Pipe Monitors

<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
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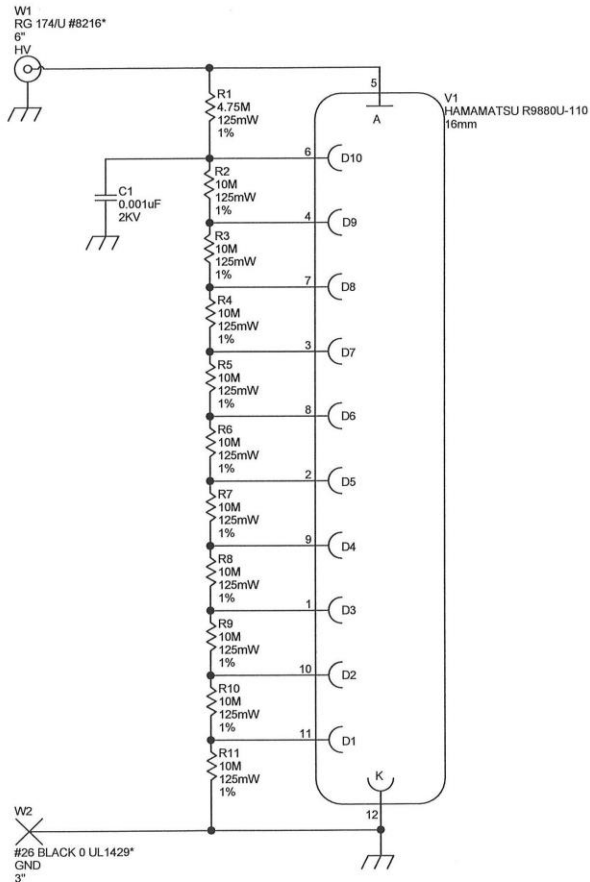
16 mm 9880V-110 Tube Socket Board
(used in Models 44-157, 44-159 & 44-159-1)

1 EA	CIRCUIT BOARD	5435-421
1 EA	CAP 0.01 μ F 2kV	04-5703
10 EA	RES 10 M, $\frac{1}{4}$ W, 1%	12-7105
1 EA	RES 4.75 M, $\frac{1}{4}$ W, 1% SMT	12-7013
1 EA	CBL-M 2401-S 7inch PIG RG174	8303-618



Model 44-157, 44-159, 44-159-1, 44-162 Gamma Pipe Monitors

16 mm 9880V-110 Schematic



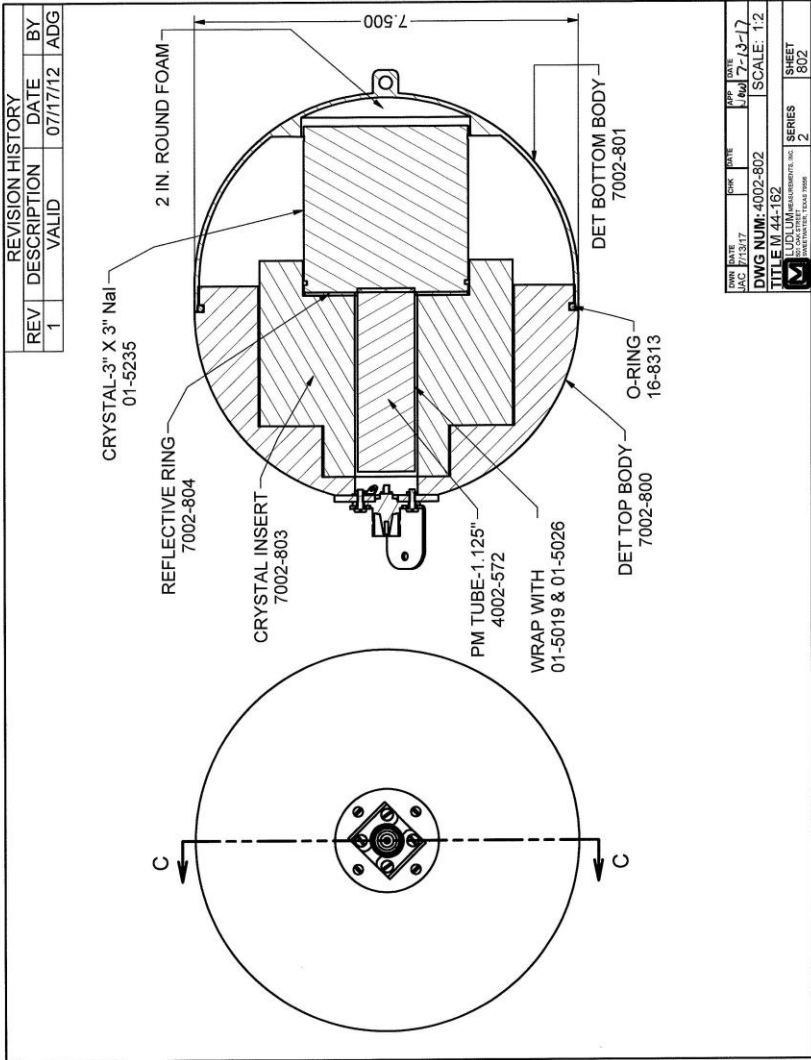
		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
		Drawn: ALC 07/31/2013	Title: 16mm COMBINED SIGNAL DIVIDER
Design: RSS 07/31/2013	Model: R9880U-110	Board#: 5435-421	
Approve: <i>[Signature]</i>	Sheet: 1 of 1	Series: 435	Sheet: 1040
Print Date: 8/1/2013 16:34 PM	Rev: 1	W:\Project\MLV\VoltageDividers\5435-421\Rev14\5421R1P1.SchDoc	

*Model 44-157, 44-159, 44-159-1, 44-162
Gamma Pipe Monitors*

Model 44-162 Gamma Pipe Monitor

<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
UNIT	Completely Assembled Model 44-162 3 x 3 inch Spherical Pipe	47-3385
1 EA	DETECTOR BODY TOP	7002-800
1 EA	DETECTOR BODY BOTTOM	7002-801
1 EA	CRYSTAL INSERT	7002-803
1 EA	REFLECTICVE RING	7002-804
1 EA	CONN ADAPTER	7002-805
2 EA	CONNECTOR PULL	7002-781
8 EA	FOAM PAD (2 inch cystal)	7260-001-05
1 EA	3 X 3 inch NaI CRYSTAL	01-5235
1 EA	PM TUBE-1.125inch B29B07	015367
9 EA	FOIL-NETIC (DARK OUTSIDE LAYERS)	01-5019
17 EA	FOIL-CO-NETIC (SHINY INSIDE LAYERS)	01-5026
1 EA	RECPT-UG568/U PANEL C FLANGE	13-7752
1 EA	O-RING-2-262	16-8313
6 EA	SCREW 6-32 X ¾ FH	17-8600
1 EA	LUG #4 LKG 1HL K908	18-8760
1 EA	NUT-4-40 SMALL PATTERN	20-9022
6 EA	WIRE-TEFLON WHITE #22 HV	21-8993
6 EA	WIRE-#22GA JSF22/168-BLK	21-9154

Model 44-157, 44-159, 44-159-1, 44-162 Gamma Pipe Monitors



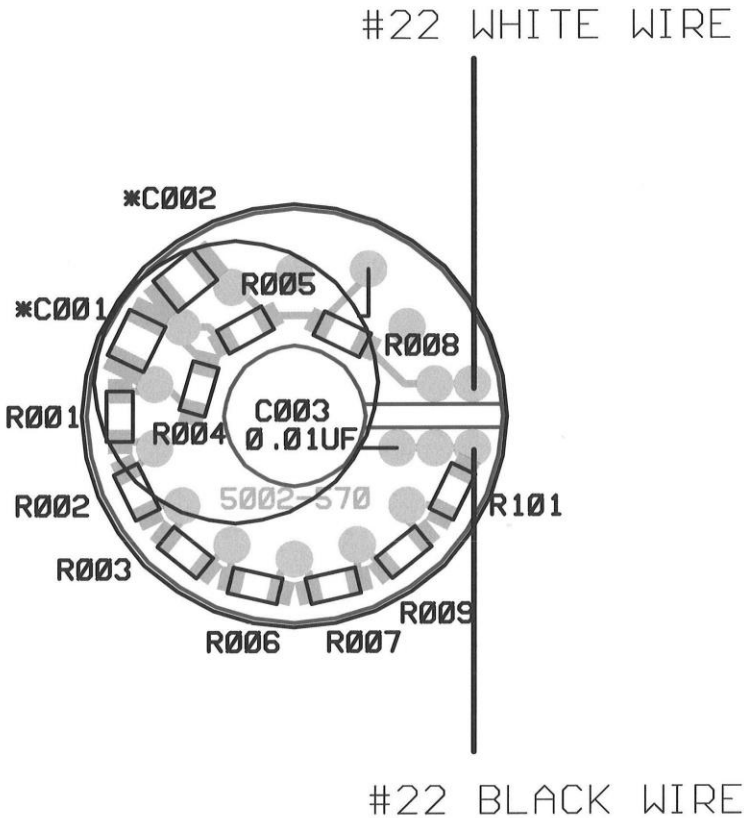
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JAC 7/13/17			Mag	7-13-17
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TITLE: M.44-162		SERIES		
LUDLUM MEASUREMENTS, INC.		2		
DALLAS, TEXAS 75243		SHEET		
		802		

Model 44-157, 44-159, 44-159-1, 44-162
 Gamma Pipe Monitors

<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
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1.125 inch Tube Socket Board
 (used in the Model 44-162)

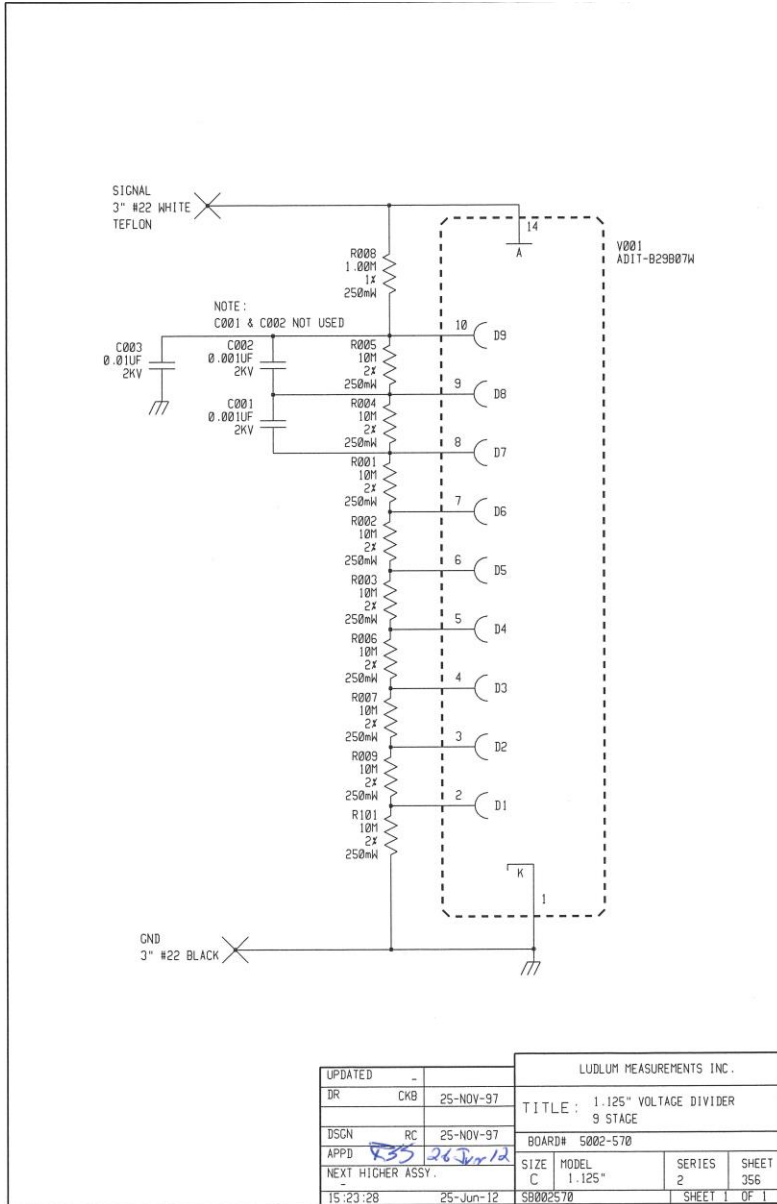
1 EA	CIRCUIT BOARD	5002-570
1 EA	CAP 0.01 μ F 3kv	04-5525
1 EA	RES 1 M, $\frac{1}{4}$ W, 1%	12-7844
9 EA	RES 10 M, $\frac{1}{4}$ W, 1%	12-7996



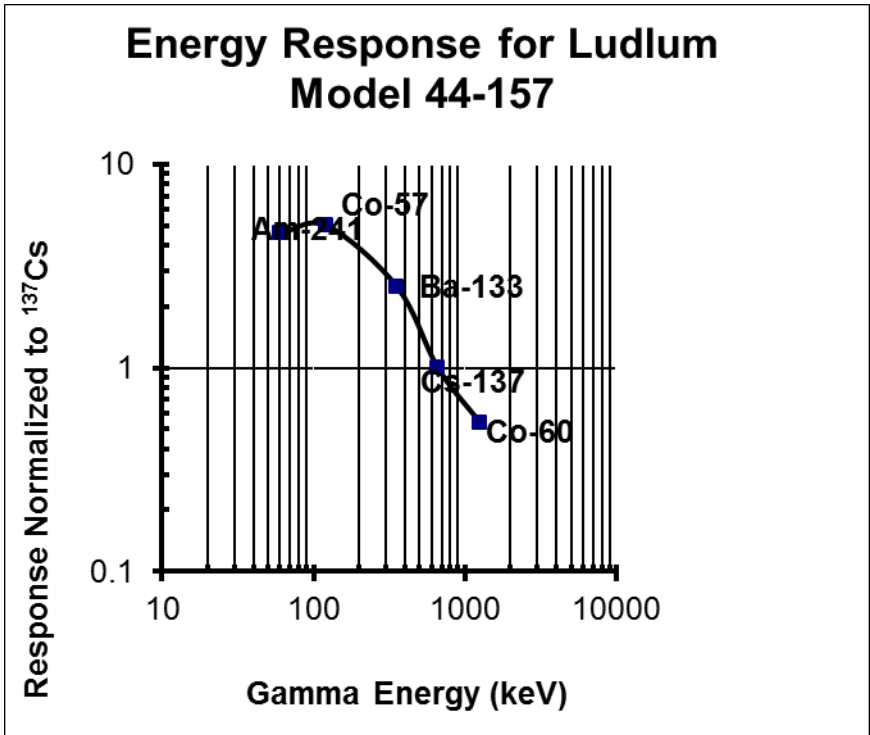
* C001 & C002 ARE NOT PLACED

Model 44-157, 44-159, 44-159-1, 44-162 Gamma Pipe Monitors

1.125 inch Tube Board Schematic



Energy Response Curves



Energy Response for Models 44-159 and 44-159-1

