

GK-B5 Kit and SBT-11A Probe Packaging Project



This outlines my efforts to show how I packaged John Giametti's DIY GK-B5 Geiger Counter kit <https://sites.google.com/site/diygeigercounter/home> in a fabricated chassis that can be made with simple hand tools. I chose his kit because of the ability to choose a wide range of anode voltages to 950v. There are many examples of using commercially available chassis, but I did not find one that suited my particular needs. The fabrication techniques for pcb chassis are found on my website http://www.qrpbuilder.com/downloads/pcb_chassis_a.pdf. The chassis dimensions are further along in this document. I used the basic GK-B5 kit, fitted with the Pololu step up/step-down regulator, a 100mm x 30mm x 6mm, 3.7v, 2000mAh Li-ion polymer battery and the suggested mini usb charger. I also wanted a belt clip bracket and a small package. I did not go to Herculean efforts to miniaturize the envelope. John's circuit design requires both the anode and cathode of the probe to be above ground potential. The chassis size is 6.0"L x 3.5"W x 1.0"H, and the total weight with battery is 306g. (10.8 oz.).

The GK-B5 was built following John's instructions with the exception of, remote mounting the speaker off the board to allow the sound to be heard through a small hole in the front panel, and the IR detector for the included remote is mounted on the reverse side of the board, with a small hole to allow sight of the IR window from the front panel. Front panel controls are, Power, Tube 1 or 2 selection, Tone/Off/Click, Reset and Select switches. There are three leds, Status, Alarm, and Count. The front panel controls and leds are mounted on an auxiliary single side homemade pcb. The pcb transfer artwork is included in this document, and the circuit board fabrication technique is detailed on:

<http://www.qrpbuilder.com/downloads/homemade%20pc%20boards.mp4>.

One end of the chassis has a ground isolated female BNC probe connector, and the opposite end has the mini usb socket, and status led's for charging the internal 3.7V Li-ion battery. The 2000mAh Li-ion battery was an inexpensive generic obtained from eBay. With the device fitted with the Polou step up regulator and the battery described, the current draw at 3.7V is approximately 57mA, I am expecting over 30 hrs. of continuous use between charges. I started with the Russian SBT-11 pancake gm tube and built a custom holder, which is also detailed here.



Partial chassis evolution, showing some of the PEM standoffs

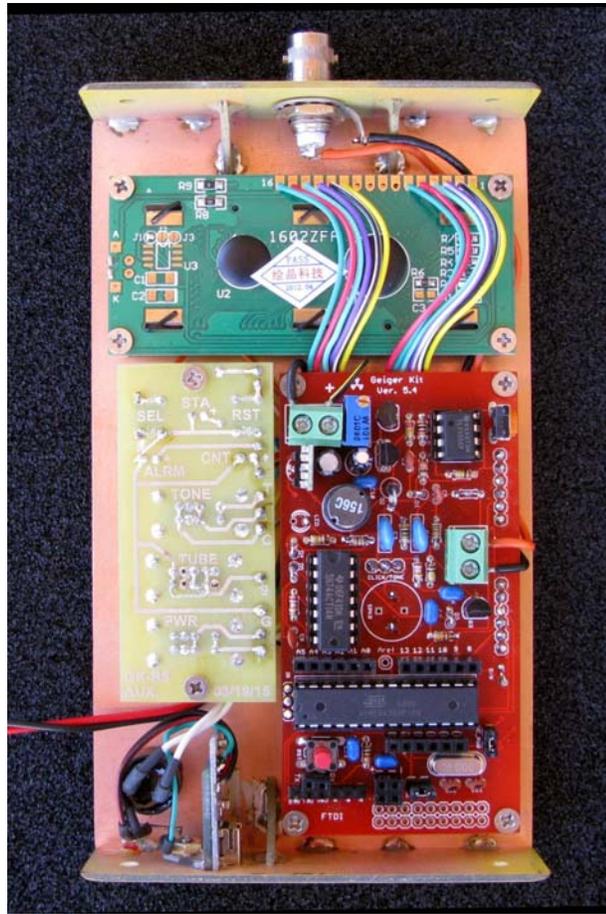
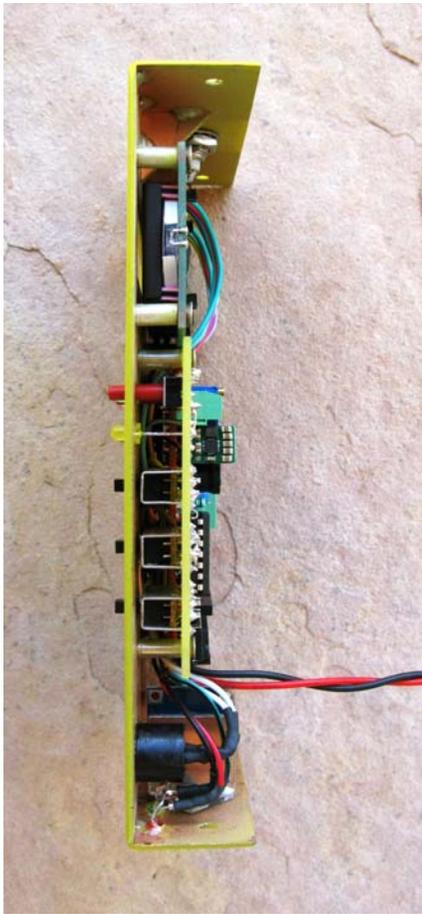


Laser waterslide decals are applied the same as the old airplane model decals. Cut around each group of text you wish to apply. It doesn't have to be perfect as the background film is transparent. Apply the decals before you mount anything to the chassis

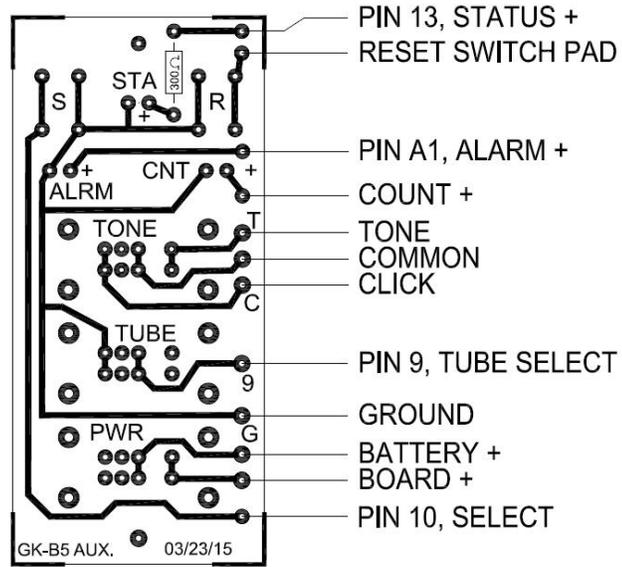
Trim around the decal. After trimming, with tweezers, dip the decal in a bowl of lukewarm water, with a small drop of dish soap to reduce the surface tension, for 10-15 seconds. Start to slide the decal off to the side of the backing paper, and place the unsupported edge of the decal close to the final location. Hold the edge of the decal against the panel, with your finger, and slide the paper out from under the decal. You can slide the decal around to the right position, as it will float slightly on the film of water. Use a knife point or something sharp to do this. When in position, hold the edge of the decal with your finger and gently squeegee excess water out from under the decal with a tissue or paper towel. Work from the center, to both sides. Remove any bubbles by blotting or wiping gently to the sides. Do this for each decal, and take your time. Allow them to dry for an hour. When dry, spray two **light** coats of clear Krylon, to seal and protect the decals, and allow the spray to dry in between coats.



Subassemblies mounted, prior to wiring



Main wiring

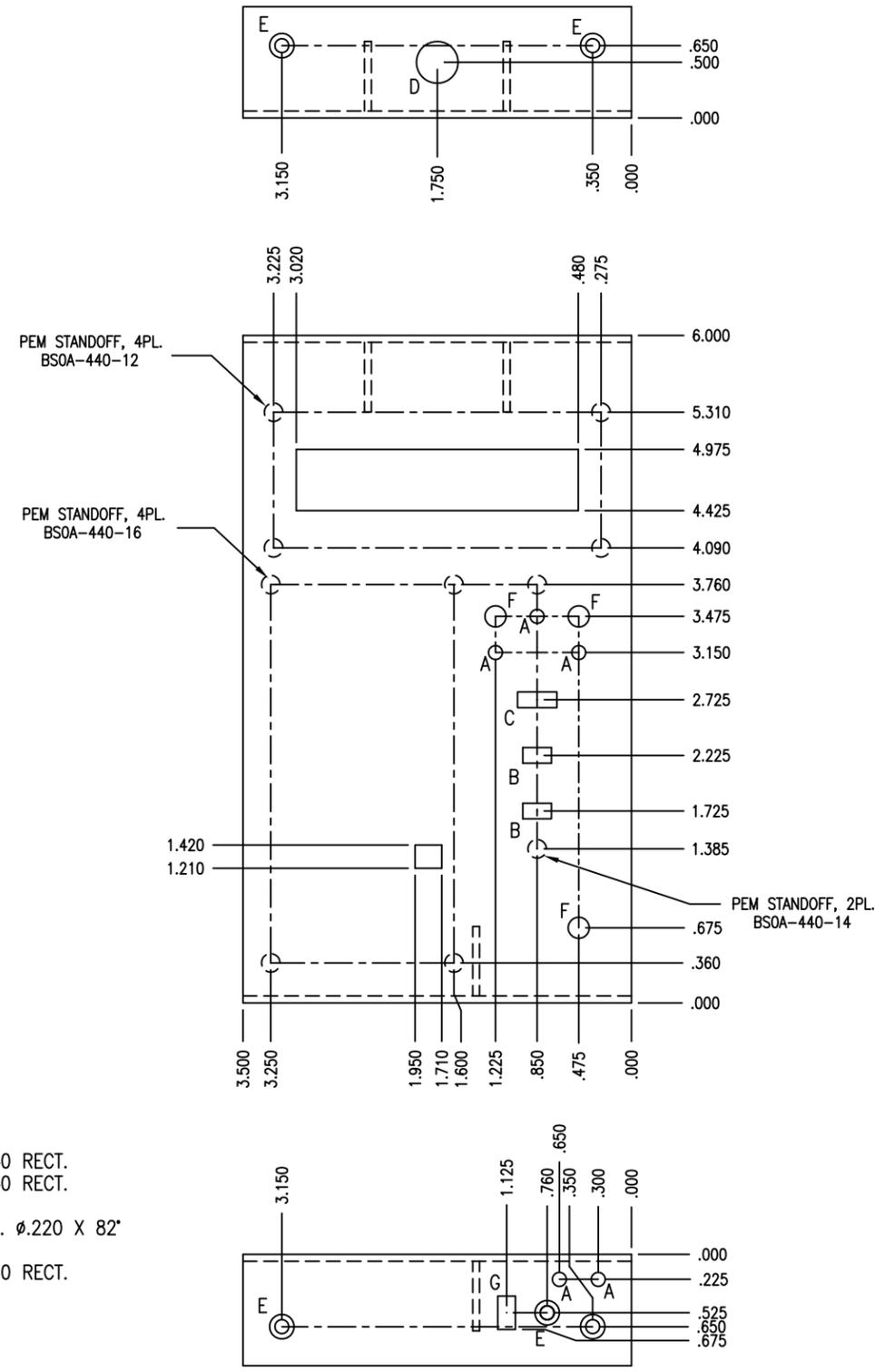
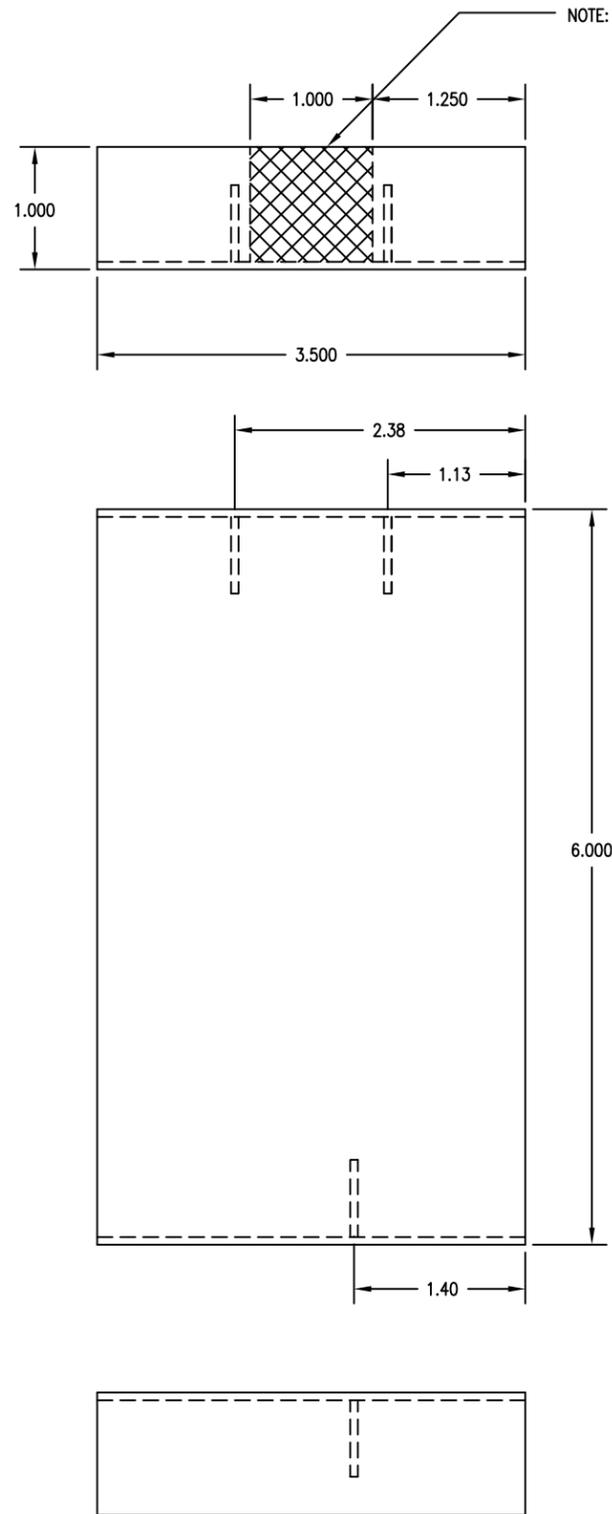


AUX. BOARD CONNECTIONS

These are my interconnections for the aux. board.

REVISIONS		
REV	DESCRIPTION	DATE

NOTE: IN THIS AREA ETCH THE COPPER OFF BOTH SIDES OF THE PCB MATERIAL, BOTH ANODE AND CATHODE MUST BE ABOVE GROUND POTENTIAL.
 ALTERNATIVE: USE ϕ .500 HOLE WITH 3/8" ID INSULATED STEP WASHER AND INSULATED 3/8" ID FLAT WAHSER, MCM #90062A017 & #95606A440



- A - ϕ .125
- B - .260 X .140 RECT.
- C - .360 X .140 RECT.
- D - ϕ .375
- E - ϕ .125, CSK. ϕ .220 X 82'
- F - ϕ .188
- G - .300 X .160 RECT.

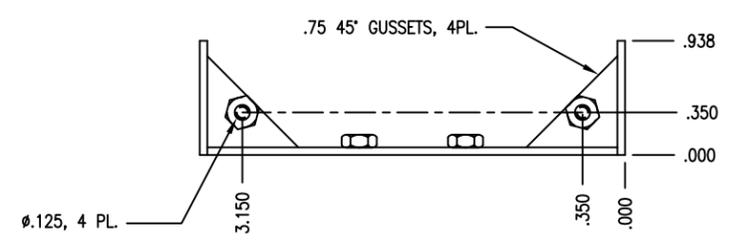
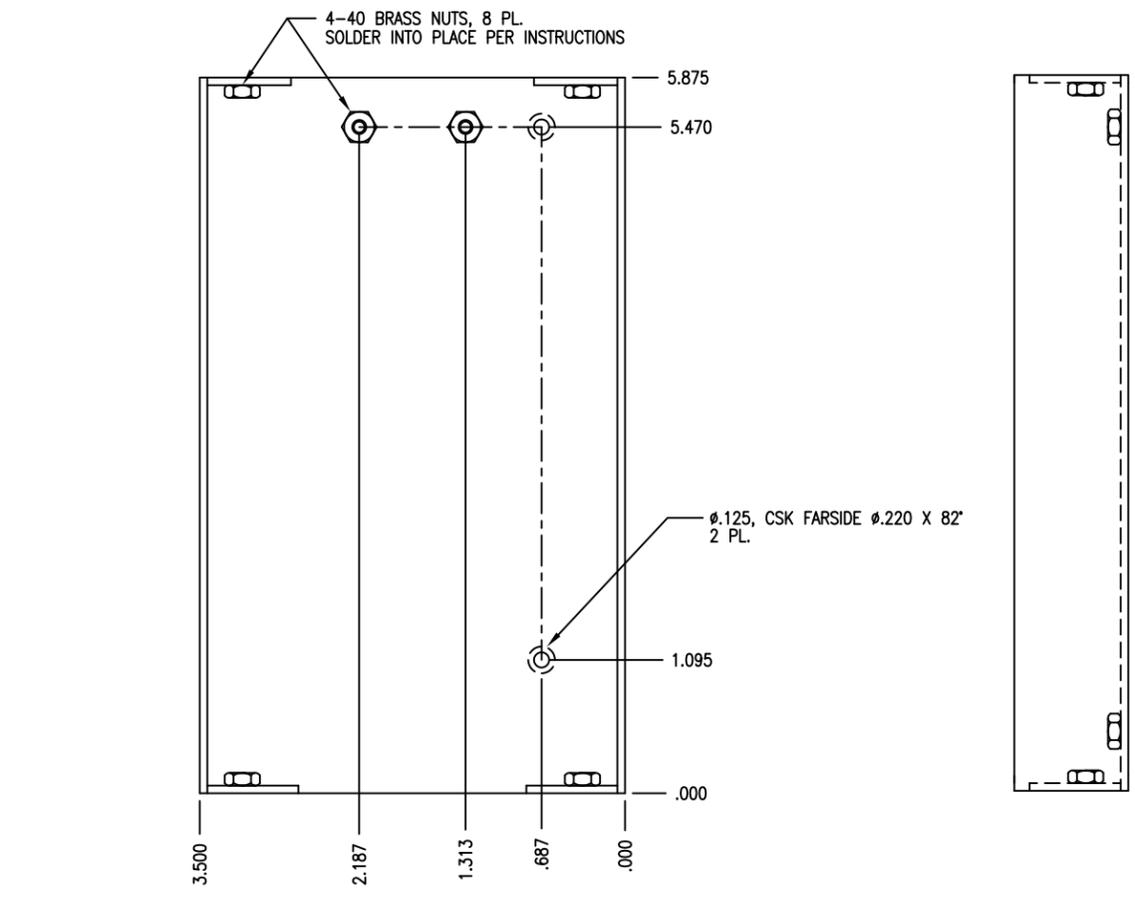
COVER

MATERIAL - G10, COPPER CLAD, BOTH SIDES, GLASS EPOXY BOARD (GAROLITE/FR-4)
 MCMaster CARR #8521K46
 REFER TO http://www.qrpbuilder.com/downloads/pcb_chassis_a.pdf FOR CONSTRUCTION TECHNIQUES

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES ARE:
 FRACTIONS DECIMALS ANGLES
 $\pm 1/32$.XX $\pm .015$ $\pm 1^\circ$
 .XXX $\pm .005$
 SURFACE FINISH $\sqrt{\quad}$
 BREAK EDGES .005-.020
 RADIUS OR CHAMFER

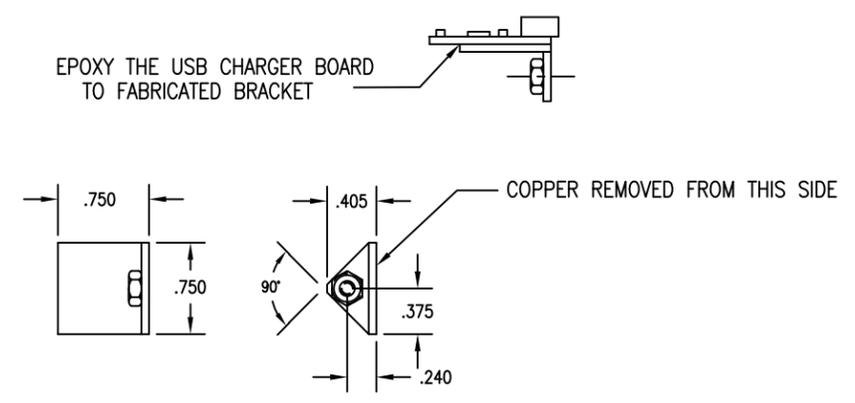
WWW.QRPBUILDER.COM		
TITLE GK-B5 GEIGER COUNTER PACKAGING		
DRAWN WA4MNT	SCALE	DATE 3/22/15
SHEET 1 OF 2	REF.	DWG.# GK-B5_PKG

REVISIONS		
REV	DESCRIPTION	DATE

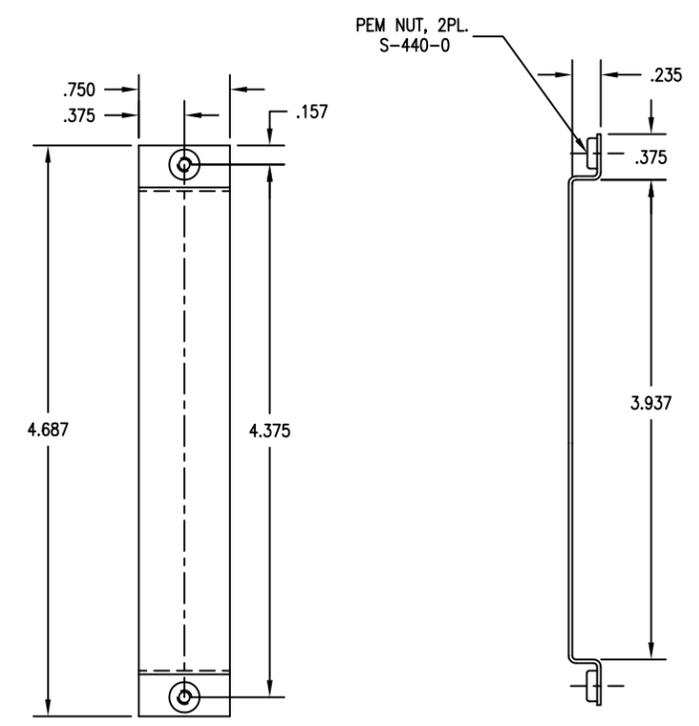


BASE

MATERIAL - G10, COPPER CLAD, BOTH SIDES, GLASS EPOXY BOARD (GAROLITE/FR-4)
MCMaster CARR #8521K46
REFER TO http://www.qrpbuilder.com/downloads/pcb_chassis_a.pdf FOR CONSTRUCTION TECHNIQUES



USB CHARGER BOARD BRACKET
MATERIAL - .06 CLAD G10



BATTERY BRACKET
MATERIAL - .03 ALUMINUM
BATTERY 100mm X 30mm X 6mm

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
± 1/32 .XX ± .015 ± 1°
.XXX ± .005
SURFACE FINISH √
BREAK EDGES .005-.020
RADIUS OR CHAMFER

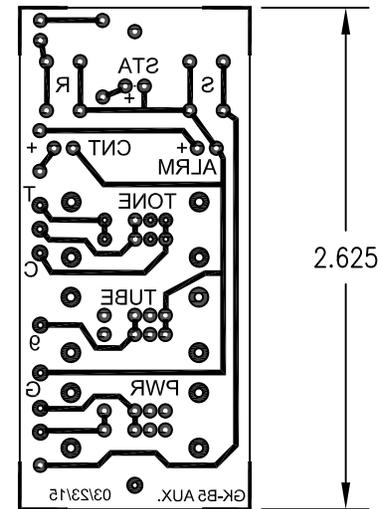
WWW.QRPBUILDER.COM			
TITLE GK-B5 GEIGER COUNTER PACKAGING			
DRAWN WA4MNT	SCALE	DATE 3/22/15	
SHEET 2 OF 2	REF.	DWG.# GK-B5_PKG	


DIY GK-B5
 Geiger Counter

SELECT	TUBE 1	TUBE 2	CLICK
RESET	STATUS	OFF	tone
COUNT	ALARM	PWR	ON

PRINT TO THIS SCALE 1:1
 3.000

PRINT FOR LASER WATERSLIDE DECALS
 SCALE LASER PRINTER TO DIMENSIONS SHOWN



BOARD TRANSFER ARTWORK
 SCALE LASER PRINTER TO
 DIMENSIONS SHOWN

ARTWORK

SBT-11A Probe Details



I was unable to find any holders for my Russian SBT-11 gm tube. This details what I came up with. I first needed to know if I could heat form some standard pvc tubing into a rectangular shape to fit the backside of the tube. I made a wooden form slightly larger than the actual bakelite dimensions. Gently heating the 1 1/4" PVC tubing with a heatgun, I was able to push it on to the form and let it cool. The gm tube comes with an aluminum bezel for the mica window side of the assembly. I gently pried that off because I wanted to add a screen to protect the mica window from any damage. I used a small rectangular piece of regular hot dipped zinc hardware cloth inside the aluminum bezel, and

reassembled the pieces with 100% silicone sealant. I made two handles, one short, and the other about 3 feet long to make it easier to scan standing up. The anode resistor is mounted at the tube pins, and the SBT-11A head is easily moved to the other handle with a single screw and quick disconnect anode connections.



Housing heated and formed



Cut and trimmed

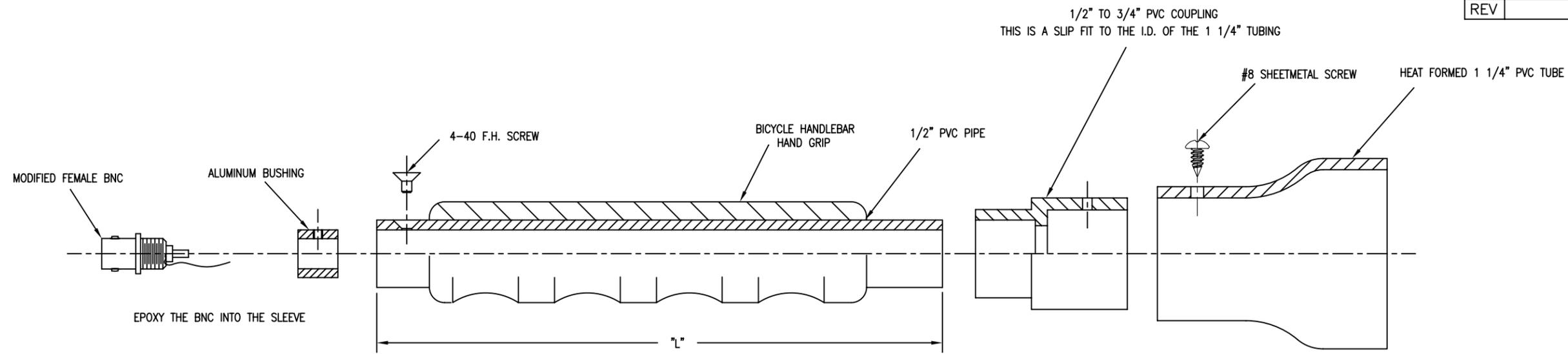


Hardware cloth shield



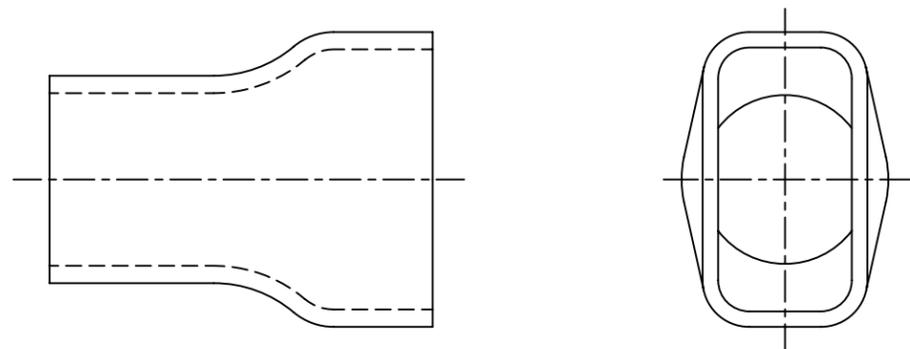
Handle grip

REVISIONS		
REV	DESCRIPTION	DATE



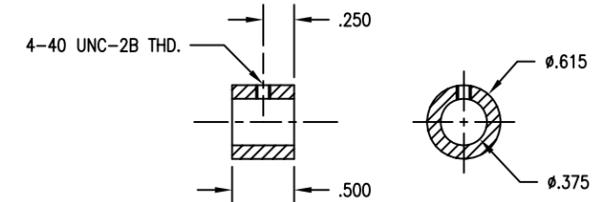
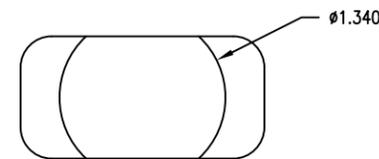
THE LENGTH OF "L" CAN BE MADE ANYTHING REASONABLE. IF MALE AND FEMALE CONNECTORS ARE USED FOR THE ANODE/CATHODE CONNECTIONS, THE SENSOR END OF THE PROBE CAN BE USED WITH DIFFERENT HANDLE LENGTHS.

SBT-11 PROBE HOUSING ASSEMBLY

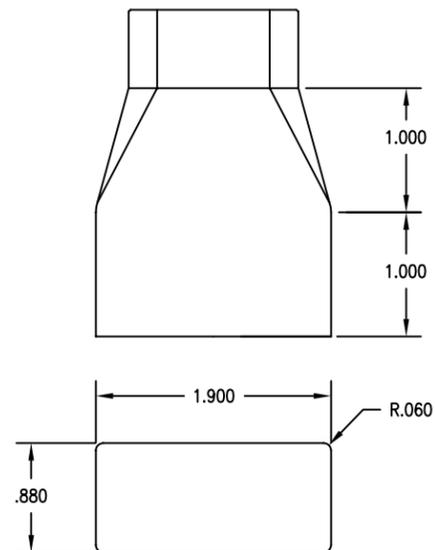


SBT-11 PROBE HOUSING

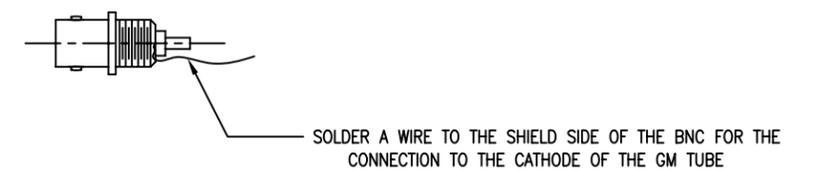
MATERIAL - 1 1/4" SCH40 PVC PIPE
PIPE HEATED AND FORMED OVER WOODEN MODEL OF SBT-11 HOUSING



ALUMINUM BUSHING



WOOD FORM

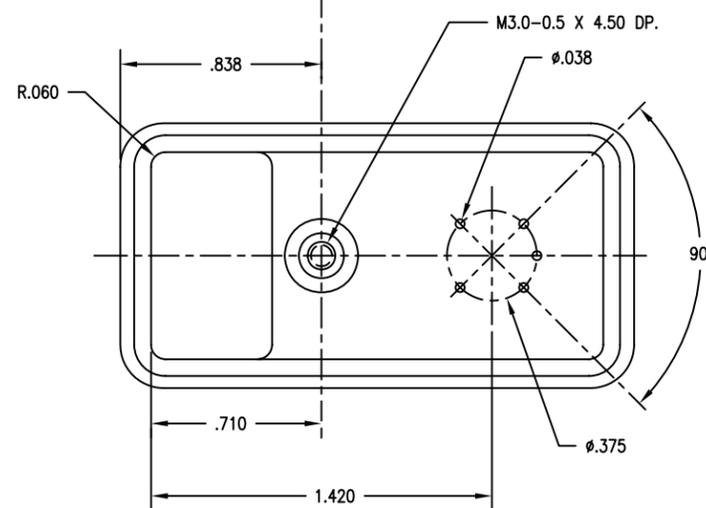
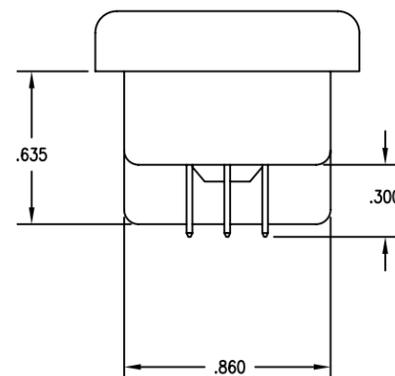
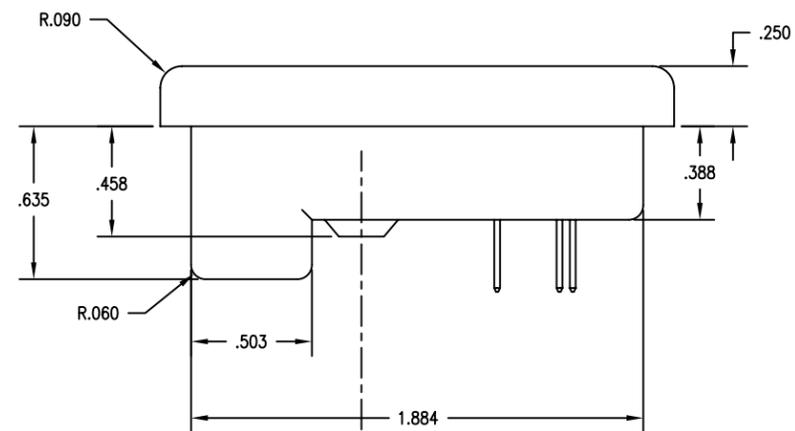
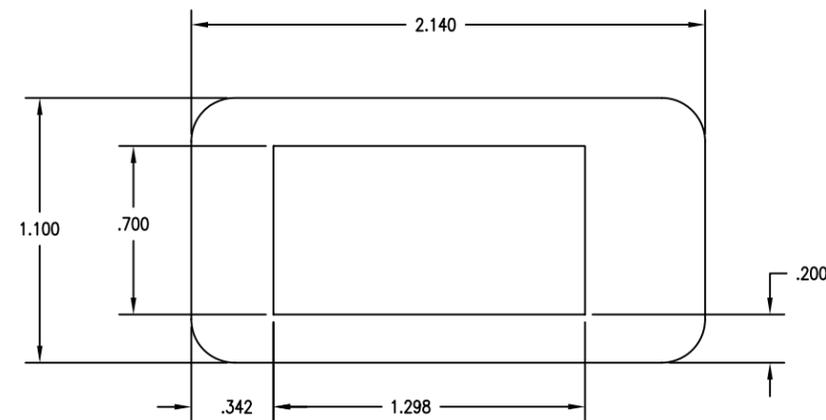


BNC CONNECTOR PREP.

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
 $\pm 1/32$.XX $\pm .015$ $\pm 1^\circ$
.XXX $\pm .005$
SURFACE FINISH $\sqrt{\quad}$
BREAK EDGES .005-.020
RADIUS OR CHAMFER

WWW.QRPBUILDER.COM		
TITLE SBT-11A PROBE HOUSING		
DRAWN WA4MNT	SCALE	DATE 3/22/15
SHEET 1 OF 1	REF.	DWG.# SBT-11_HSG

REVISIONS		
REV	DESCRIPTION	DATE



Содержание ценовых металлов

Алюминий СБТ10, СБТ10А 5,0 г
СБТ11, СБТ11А 24,3 г в крышке

Латунь СБТ10, СБТ10А 1,4 г по штуку

Счетчик СБТ 11 соответствует техническим условиям 020.339.306 ТУ.

Испыт ОТК 2.02.9.0
Исполнители: [подпись], [подпись]
Перепроверка: [подпись] дата _____

Испыт ОТК _____

Счетчики СБТ10, СБТ10А, СБТ11, СБТ11А

ЭТИКЕТКА

Счетчики СБТ10, СБТ10А, СБТ11, СБТ11А Гейгера-Мюллера бета-части производимые для регистрации бета-излучений от 0,156 МэВ.

Климатическое исполнение УХЛ 3.1.

Схема соединения электродов

Для счетчиков СБТ10, СБТ10А

Для счетчиков СБТ11, СБТ11А

Наименование параметра, единица измерения	Н о р м а	
	не менее	не более
Напряжение начала счета, В СБТ10, СБТ10А СБТ11, СБТ11А	260	320
	260	320
Протяженность плато счетной характеристики, В СБТ10, СБТ10А СБТ11, СБТ11А	80	-
	80	-
Наклон плато счетной характеристики, % на 1 В СБТ10, СБТ10А СБТ11, СБТ11А	-	0,3
	-	0,5
Наклон вольт-амперной характеристики четырех секций, % на 1 В СБТ11, СБТ11А	-	1,5
	-	1,5
Ток четырех секций, мкА СБТ11, СБТ11А	4	10
	0,3	1,5
Ток одной секции, мкА СБТ11, СБТ11А	0,3	1,5
	0,3	1,5

Наименование параметра, единица измерения	Н о р м а	
	не менее	не более
Собственный фон, имп/с СБТ (T=55 °C ± 3 °C) СБТ10А (T=55 °C ± 3 °C) СБТ11, СБТ11А (T=25 °C ± 10 °C) СБТ11 (T=50 °C ± 3 °C) СБТ11А (T=50 °C ± 3 °C)	-	4,17
	-	2,17
Чувствительность, имп/мкР от 137Cs СБТ10, СБТ10А (при R=4 мкР/с) СБТ11, СБТ11А (при R=10 мкР/с)	322,5	402,3
	41,5	54,5
Амплитуда импульсов, В СБТ10, СБТ10А СБТ11, СБТ11А	5	-
	10	-
Сопротивление изоляции цоколя, Ом СБТ10, СБТ10А СБТ11, СБТ11А	10 ¹⁰	-
	10 ⁹	-
Эффективность регистрации бета-излучения, % СБТ10, СБТ10А СБТ11, СБТ11А	35	-
	30	-

Допуски металлов по чертежам.

Voltage start counting – 260V–320V;
 Nominal working voltage – 400V
 The length of the plateau counting device characteristics Geiger–Muller SBT–11A – no less than 80 V;
 The slope of the plateau counting characteristic – no more than 0.5% / V;
 The slope of the voltage–current characteristics of the four sections of the instrument Geiger–Muller SBT–11 – no more than 1.5% / 1B;
 The current four sections – 6mA–11mA;
 One section of the current – 0.5 mA–1, 1mA;
 Pulse amplitude unit Geiger–Muller SBT–11 – not less than 10 V;
 Sensitivity to gamma radiation – 44imp/mkR–49imp/mkR;
 Counting Speed – 440imp/s–490imp/s;
 Own background – 2.50 imp / s;
 Insulation resistance base unit Geiger–Muller SBT–11 – 3 ? 10 9;
 Output capacity – 8pF–12pF;
 The efficiency of detection of beta radiation – at least 20%.
 CPM : uSv/h = 318

UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES
 TOLERANCES ARE:
 FRACTIONS DECIMALS ANGLES
 ± 1/32 .XX ± .015 ± 1°
 .XXX ± .005
 SURFACE FINISH ✓
 BREAK EDGES .005–.020
 RADIUS OR CHAMFER

WWW.QRPBUILDER.COM		
TITLE SBT-11/SBT-11A α/β/γ GM TUBE		
DRAWN WA4MNT	SCALE	DATE 3/22/15
SHEET 1 OF 1	REF.	DWG.# SBT-11_GM