High Voltage Differential Probe

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Main characteristics:

- Based on the AD8479, Very High Common-Mode Voltage Precision Difference Amplifier, which includes internal precision resistors.

See:
http://www.analog.com/media/en/technical-documentation/data-sheets/AD8479.PDF

- Gain = 1.000 within 0.1%.

- Common mode rejection typically better than 100 dB @ 100 Hz

- Maximum peak voltage allowed: +/- 600 V

- Frequency response: DC to 130 KHz at X1 attenuation.

The following features have been added:

- X100 attenuation giving DC à 160 KHz response, using precision 0.1 % resistors and adjustable CMRR plus frequency compensation.

- Power provided from a single 9V battery, using a - 9V converter.

- Low current consumption: approx. 1 mA. Allows 500 hours operation.

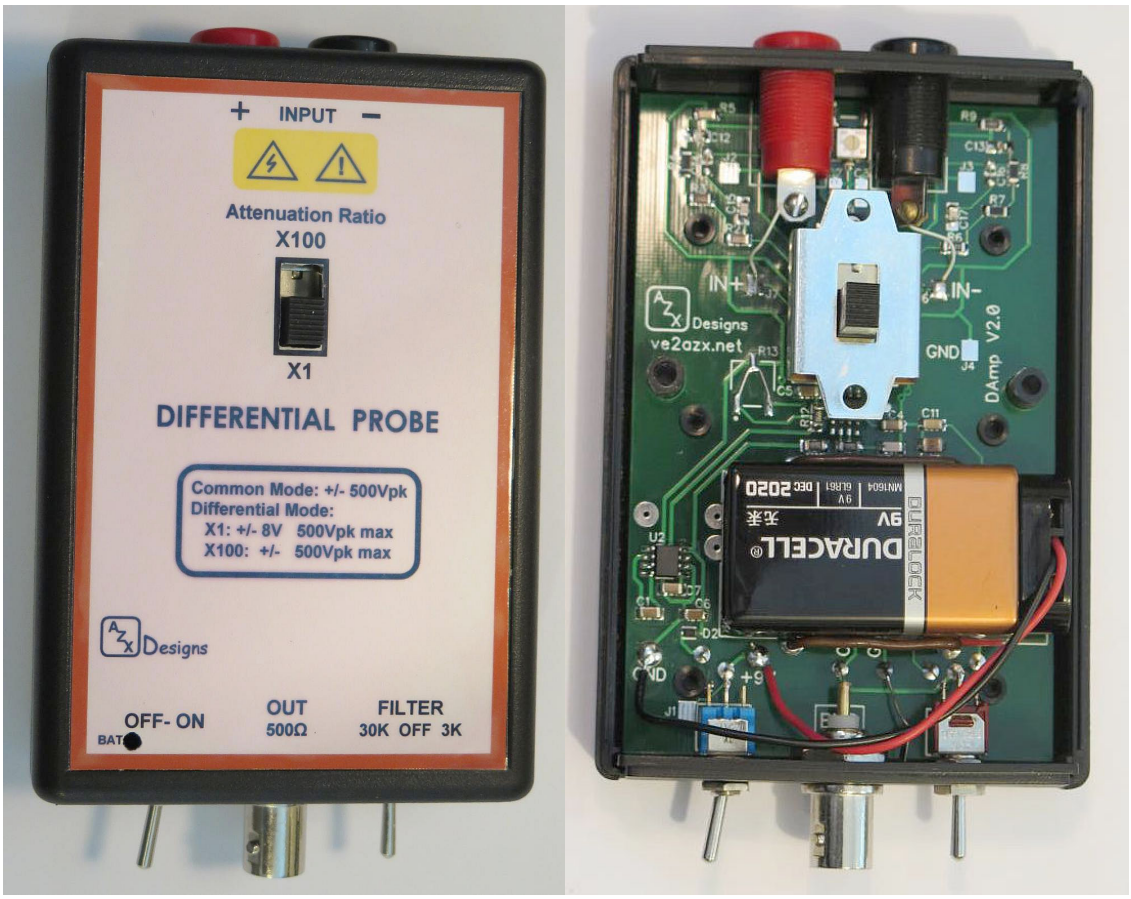
- Two selectable R-C filters reduce the residual amplifier noise. (3 KHz, 30 KHz or none).

- Built in a standard ABS enclosure, using safety banana jacks.

- Conformal Coating added on the high voltage section of the PCB prevents humidity from affecting PCB isolation.

- Protection against battery polarity reversals.

- **PRICE of the probe**: $ 79 US. Payable by Paypal to my videotron address appearing on the main page of my site: ve2azx.net
  Delivery costs in US and Europe, by plane, without tracking or insurance: $ 10.



Differential probe – exterior and interior views.

Kit Contents:

- Assembled PCB, tested and adjusted.
- ABS enclosure.
- (1) Enclosure end plate with banana connectors installed.
- (1) Enclosure end plate with holes drilled to mount the BNC connector and the two switches. Copper tape provided for grounding.
- (2) Sub-miniature switches.
- (1) BNC connector with lug and mounting hardware.
- (1) 9V battery connector.
- (1) Photo paper for the probe front plate. To be glued to the case.
- (1) Transparency film to be applied on the photo paper.
- Solid wire AWG #20 insulated, to support the battery. Short length of #30 AWG wire.

Final assembly of the probe

The PCB is installed in the lower part of the enclosure. There is no need to glue it or use mounting screws. It may be removed by delicately prying it upwards.

1- Bend and solder the solid wires (3) that hold the battery in position.
See photo 1. Cut two wires 2 in. long and another 1.2 in.
Cut the wires flush with the PCB underneath, as required.

2- Install the copper tape inside the small end panel for the switches and BNC connector. Clear the copper inside the holes.

3- Install the two switches on the small end panel and the BNC connector.
Position the ground lug on the proper side.

4- Install the small end panel in the lower enclosure and wire the switches and the BNC.
Do not apply excessive heat on the switch terminals.
Solder the +9V battery connector. Shorten leads as required.

5- Install the second end panel with its two banana connectors.
The red connector is wired to the **+** IN and the black goes to the **-** IN. Photo 2.

6- Place the transparent film on the top of the photo paper.
Cut all around the black line on the photo paper.
Glue the photo paper on the top of the enclosure. Use the minimum amount of glue.
Too much glue causes the photo paper to absorb the glue and the writings become blurred.

7- Using a small knife, clear the space for the X1-X100 switch knob.
Also make a a small hole to check the battery voltage without opening the probe enclosure. (hole already drilled)

8- Connect the 9V battery and close the enclosure using the two screws provided.
The probe is now ready to be used.

Probe Usage

For your safety: Never use the probe when condensation occurs on the enclosure.
The author cannot be held responsible for personal damage or injury caused by using this probe.

The probe allows an oscilloscope to measure differential voltages in a circuit.
It may be used to measure voltages where ground loops may be present.
The probe output impedance is 500 ohms. A 1 megohm minimum load is recommended.
This loading effect will reduce the gain by 0.05%.
The probe may also be used with the Low Frequency Adapter (LFA) connected to a Vector Network analyzer (VNA). With the probe connected to the LFA RX input, it becomes possible to drive a 50 ohm load via the LFA Monitor output.
See: http://ve2azx.net/technical/LFA/LowFreqAdapter.htm

Maximum Voltage versus Battery Voltage and Attenuation setting.

	X1 ATTENUATION Common mode			X100 ATTENUATION Common mode		
Battery V	Max Vpk	Max RMS	MAX SAFE Vpk	Max Vpk	Max RMS	MAX SAFE Vpk
9.5	480	339	600	700	495	700
9	450	318	600	700	495	700
8.5	420	297	600	700	495	700
8	390	276	600	700	495	700
7.5	360	255	600	700	495	700
7	330	233	600	700	495	700

The Max Vpk and Max RMS values above are the maximum common mode values that preserve linearity.
Exceeding the MAX SAFE Vpk values may cause permanent damage to the probe and is potentially dangerous for the operator.

	X1 ATTENUATION Differential mode			X100 ATTENUATION Differential mode		
Battery V	Max Vpk	Max RMS	MAX SAFE Vpk	Max Vpk	Max RMS	MAX SAFE Vpk
9.5	8	5.7	600	700	495	700
9	7.5	5.3	600	700	495	700
8.5	7	4.9	600	700	495	700
8	6.5	4.6	600	700	495	700
7.5	6	4.2	600	700	495	700
7	5.5	3.9	600	650	460	700

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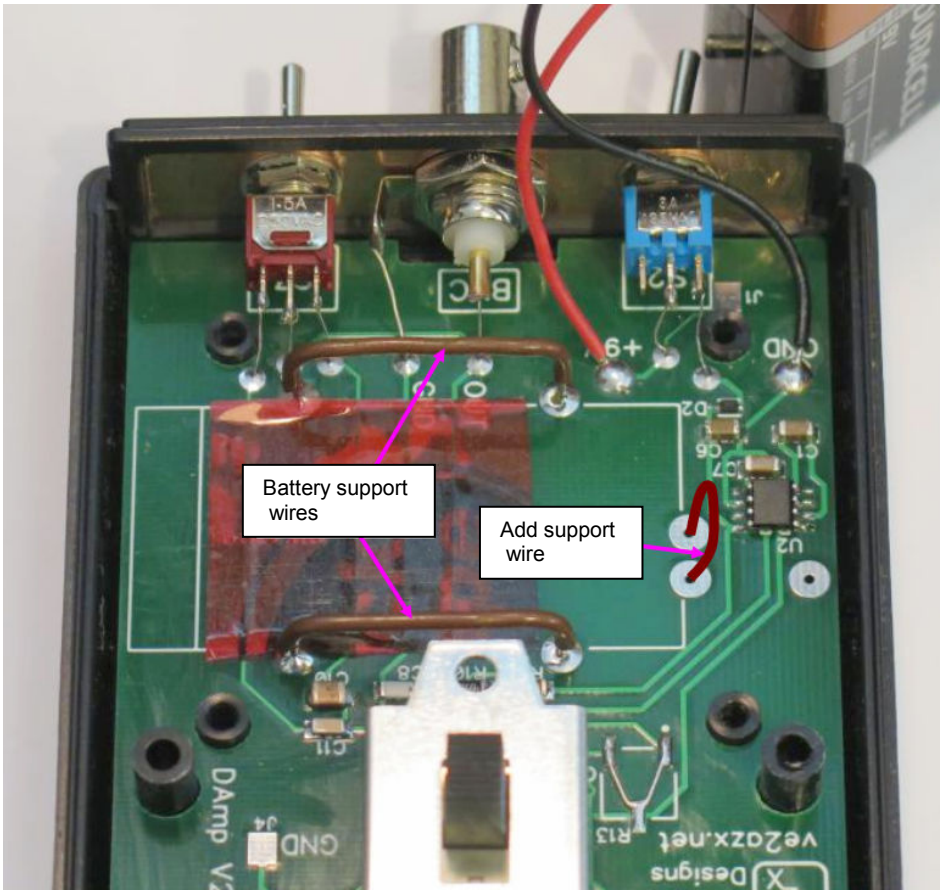


Photo 1. Installing the support wires and wiring the switches and BNC connector.

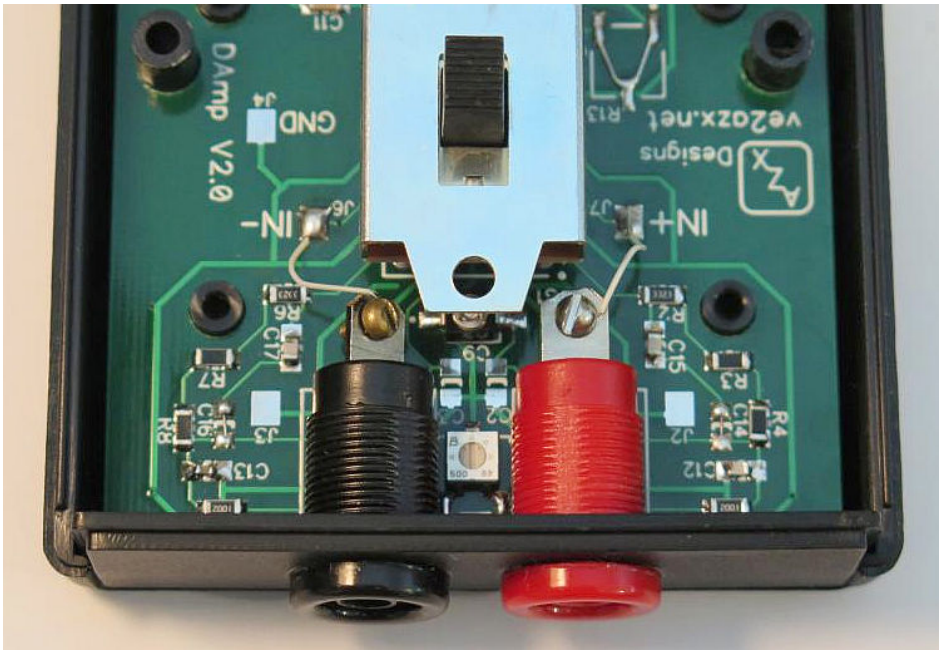
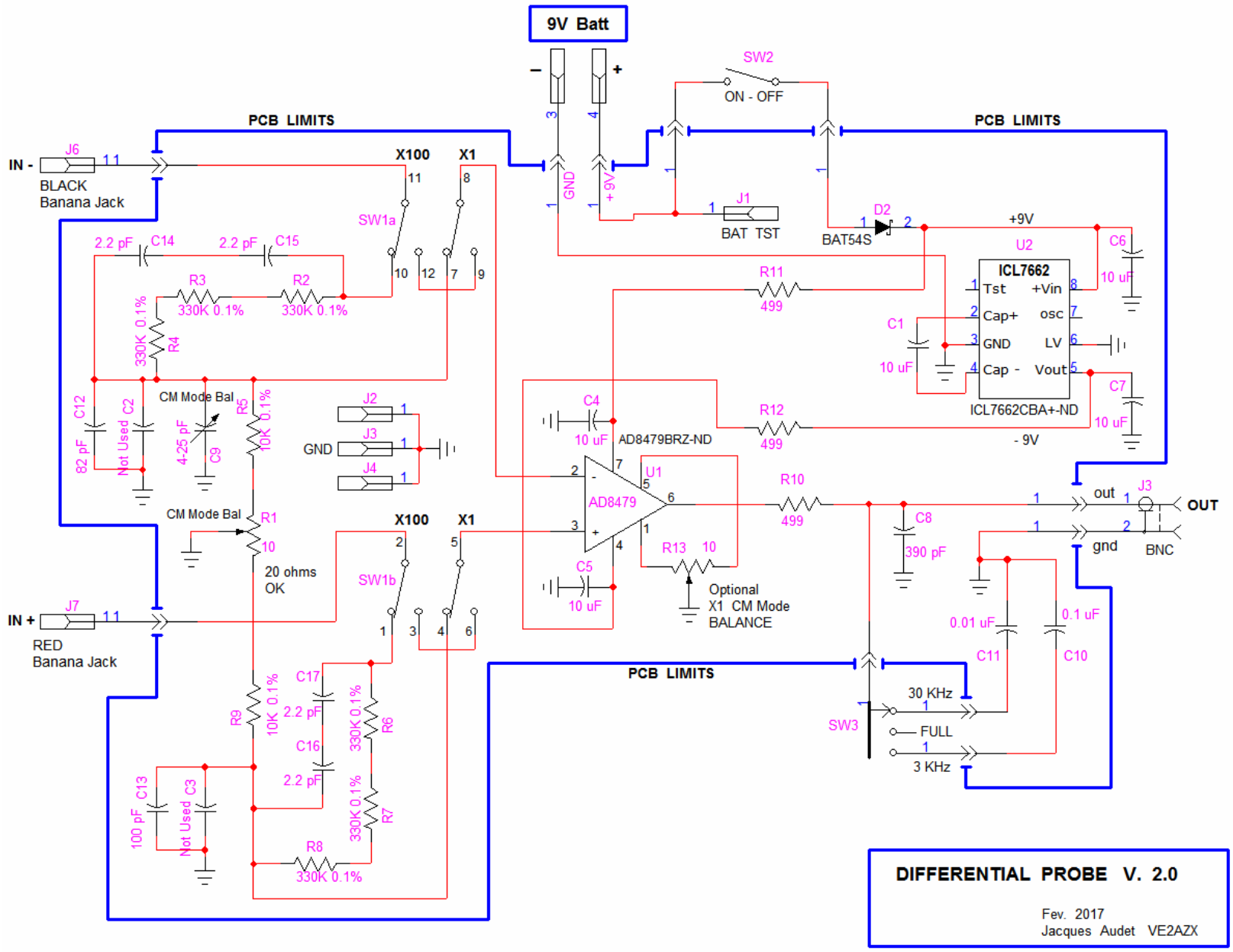


Photo 2. Wiring the banana connectors.


9V Batt
SW2
ON - OFF
PCB LIMITS
PCB LIMITS
IN -
J6
BLACK
Banana Jack
X100
X1
SW1a
J1
BAT TST
D2
BAT54S
+9V
U2
ICL7662
Tst
+Vin
Cap+
osc
GND
LV
Cap -
Vout
ICL7662CBA+-ND
C6
10 uF
C7
10 uF
C1
10 uF
R11
499
R12
499
- 9V
2.2 pF
C14
2.2 pF
C15
R3
330K 0.1%
R2
330K 0.1%
R4
330K 0.1%
C12
82 pF
C2
Not Used
CM Mode Bal
C9
4-25 pF
R5
10K 0.1%
J2
J3
GND
J4
C4
10 uF
AD8479BRZ-ND
U1
AD8479
R10
499
C8
390 pF
out
J3
OUT
gnd
BNC
CM Mode Bal
R1
10
20 ohms
OK
SW1b
R13
10
Optional
X1 CM Mode
BALANCE
C5
10 uF
IN +
J7
RED
Banana Jack
PCB LIMITS
0.01 uF
C11
0.1 uF
C10
30 KHz
SW3
FULL
3 KHz
C17
2.2 pF
C16
2.2 pF
R9
10K 0.1%
R6
330K 0.1%
R7
330K 0.1%
R8
330K 0.1%
C13
100 pF
C3
Not Used
DIFFERENTIAL PROBE V. 2.0
Fev. 2017
Jacques Audet VE2AZX