

Electrical Engineering Stack Exchange is a question and answer site for electronics and electrical engineering professionals, students, and enthusiasts. It only takes a minute to sign up.

Anybody can ask a question



Anybody can answer

Sign up to join this community

The best answers are voted up and rise to the top



## Building an instrumentation amplifier

Asked 7 years ago   Modified 3 years, 6 months ago   Viewed 630 times



2



I am trying to develop a system for bioimpedance measurement.

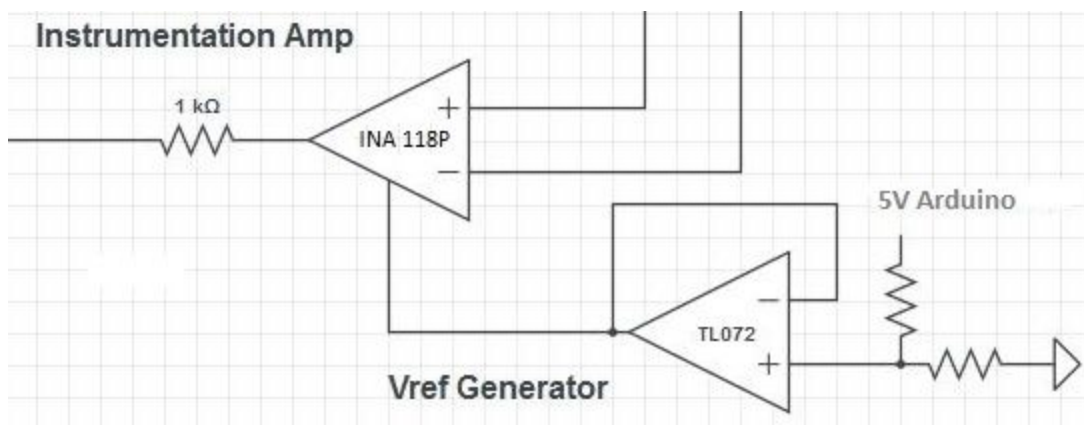
I will use a frequency equivalent to 50KHz, using [this project to support me](#).

The project uses an instrumentation amplifier. In my city I just found the INA111, but it is a very expensive component, so I decided to make my own instrumentation amplifier using three Op Amps (TL084CN).

I'm using this article to support me [Design of an Instrumentation Amplifier - Justin Bauer](#).

### My doubt is:

Since the AD5933 can only read positive voltages, an input of 2.5V is connected into the Vref terminal of instrumentation amplifier (INA118P). This is done to 'convert' the AC voltage to DC (I think).



## How do I do that? If I do not have terminal Vref on my "home Instrumentation Amplifier"?

Sorry, my English is bad (I'm not American), and I'm starting with electronics.

operational-amplifier

impedance

instrumentation-amplifier

biopotential

Share Cite Follow

edited Oct 29, 2016 at 6:28



LorenzoDonati4Ukraine  
-OnStrike

24.4k 5 64 107

asked Oct 29, 2016 at 4:52



Dyarlen Iber

51 1 1 8

You do have a ref terminal on your homebrew inamp. It's the ref of the output diffamp. How about you post a schematic of what you're intending to brew, then we can point it out. Might be able to point out a few other things as well if you include the whole circuit, so power supply, input biasing. You have a valuable resource here, might as well mine it for what you can. – Neil\_UK Oct 29, 2016 at 5:25

The TL084 may be too noisy for your application. Try to get a less noisy part, for example the TL074 should be in the same price range and has similar specs otherwise. Or use two TL072, since you already have one in your bill of materials. – LorenzoDonati4Ukraine-OnStrike Oct 29, 2016 at 6:31

Categorically, a three op amp formulation will not give you the CMRR of the most inexpensive off the shelf op amps – Scott Seidman Oct 30, 2016 at 22:05

## 2 Answers

Sorted by: Highest score (default)



2

The "vref" input of a instrumentation amplifier is just a DC offset on the output. Its use here doesn't convert AC (oscillating) to DC (steady) voltage, but just adds a DC offset to the waveform so that it is oscillating between (say) +3V and +1 V, rather than between +/- 1V.



You can see how it works in the datasheet of the INA118:

<http://www.ti.com/lit/ds/symlink/ina118.pdf>, which shows the standard 3-opamp schematic, including the vref input. I googled the reference you mentioned:

[http://www.egr.msu.edu/classes/ece480/capstone/spring15/group05/uploads/4/7/5/1/47515639/ece\\_480\\_app\\_note\\_justin\\_bauer.pdf](http://www.egr.msu.edu/classes/ece480/capstone/spring15/group05/uploads/4/7/5/1/47515639/ece_480_app_note_justin_bauer.pdf) here, it is just shown using ground as the reference voltage, but that is easily changed: disconnect R2 from ground, and connect it to your desired reference voltage.

Share Cite Follow

answered Oct 29, 2016 at 5:26



Evan

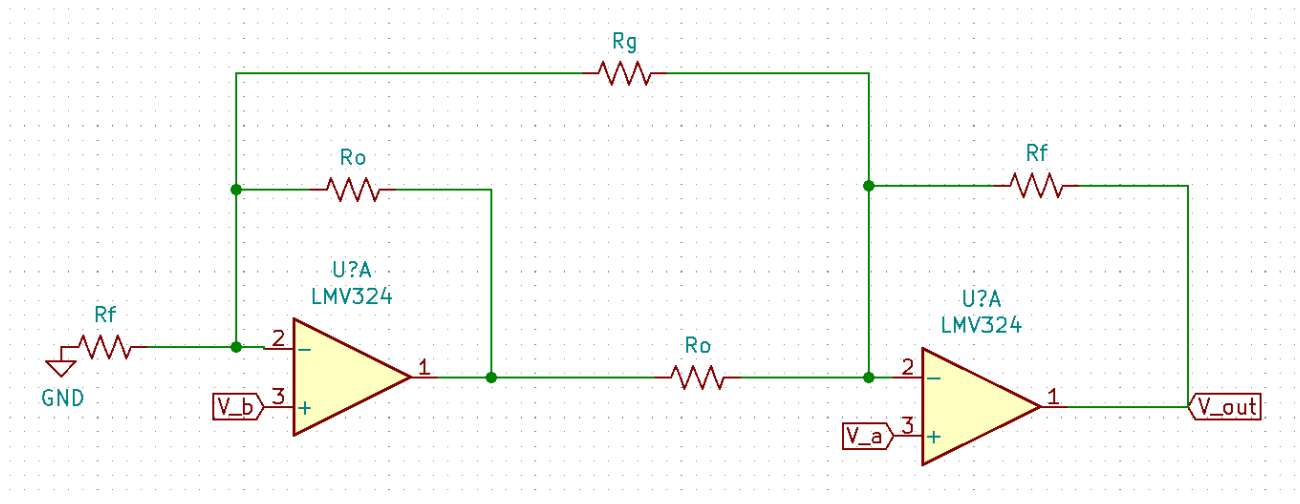
2,449 10 17



0



A cheaper instrumentation amplifier can be designed by using only 2-op Amps + 5 resistors , in place of the conventional 3-op amp + 7 resistors design . Of course, you would have to compromise on the CMRR .This can be done by following the schematic as shown below.



From simple KCL equations at inverting terminals of op-amps , we can get the equation for

$V_{out} = (V_a - V_b) (1 + [R_f/R_o] + [2R_f/R_g])$  , where  $R_g$  is the gain tuning resistor used.

Using such a scheme may help in in cases where cost of IA being designed is an issue, but CMRR is not very stringent.

Share Cite Follow

answered May 7, 2020 at 12:41



Abhishek Chunduri

318 2 6 15