Code

Github location: https://github.com/mmuldo/total

Quickstart

- git clone git@github.com:mmuldo/total.git
- cd total
- mkdir build

Building Code

From the root of your total directory

- cd build
- cmake ..
- make

This will output a “conductivity.uf2” file.

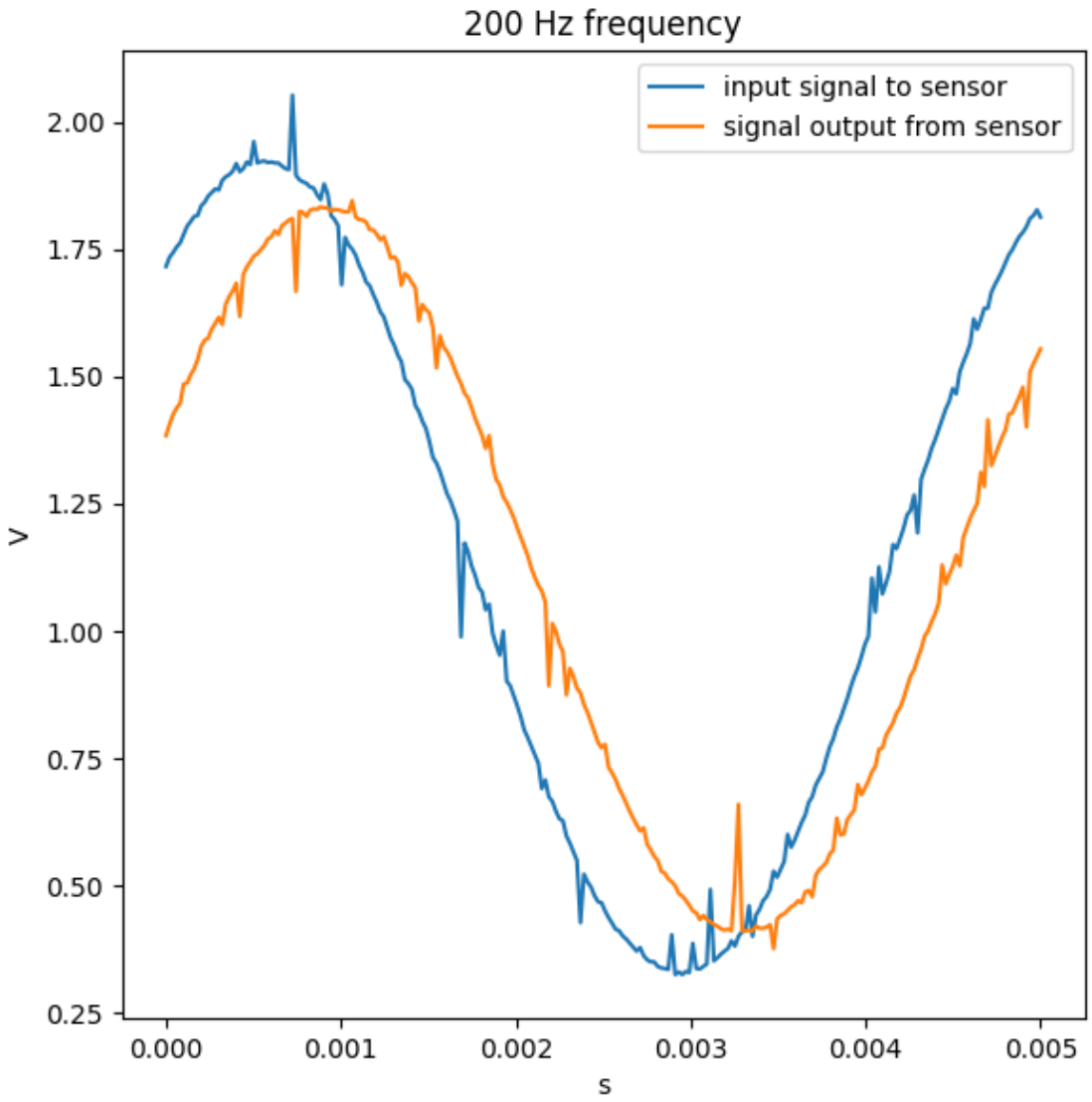
Getting binary onto pico

- make sure pico is unplugged from computer
- hold down “BOOTSEL” button (white button) on pico
- while still holding down “BOOTSEL,” plug pico back into computer
- release “BOOTSEL.” pico should show up as a drive on your computer
- move “conductivity.uf2” onto pico drive and unmount
    - Linux
        - sudo mount [pico drive location] /mnt
        - sudo cp conductivity.uf2 /mnt
        - sudo umount -r /mnt
    - Windows
        - drag and drop conductivity.uf2 to pico’s drive folder
        - right click drive and click “eject”

Running code

- unplug pico from computer then plug it back in (this just restarts the code)
- at the root of your total directory, run
    - python conductivity.py
- script will prompt user to enter desired frequency. enter the frequency you want (between 200 and 1000 Hz) then hit enter
- should return the impedance

- if you want to see plots of the sine waves, uncomment the line 63 of conductivity.py by removing the # in front, which is this line:
    - #plot(vin, vout, freq)
    - here's an example of what the plot looks like:



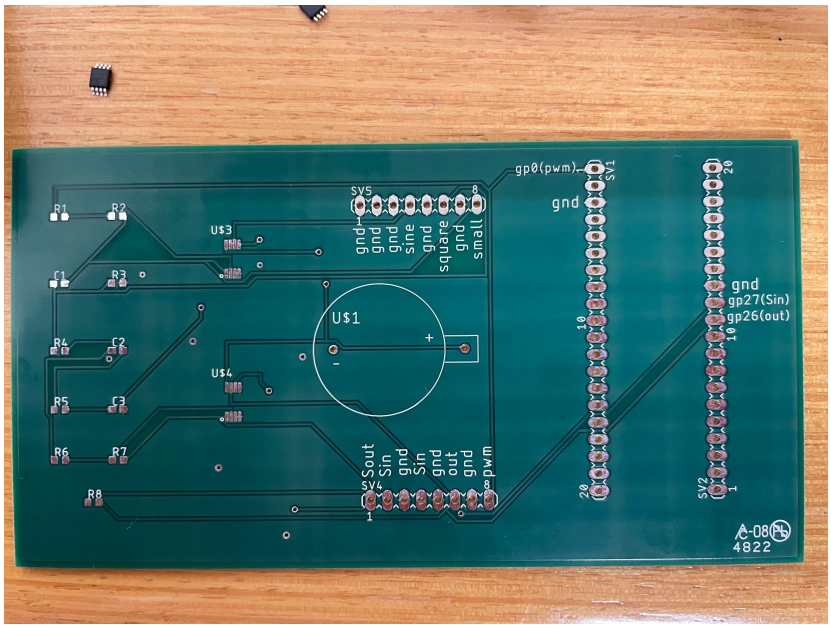
PCB and components

component name on pcb	value	digikey part number (p/n)

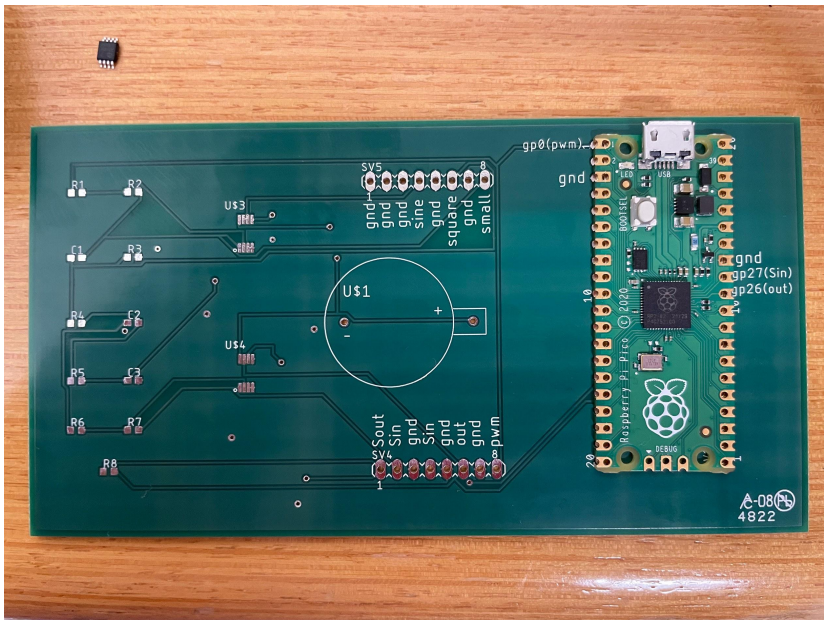
R1	6.65kΩ	CR0603-FX-6651ELFTR-ND
R2	1kΩ	CR0603-FX-1001ELFTR-ND
R3	499kΩ	CR0603-FX-4993ELFTR-ND
R4	4.99kΩ	CR0603-FX-4991ELFTR-ND
R5	4.99kΩ	CR0603-FX-4991ELFTR-ND
R6	2kΩ	CR0603-FX-2001ELFTR-ND
R7	1.5kΩ	118-CR0603-FX-1501ELFTR-ND
R8	100kΩ	CR0603-FX-1003ELFTR-ND
C1	0.033μF	399-C0603C333J5RAC7867TR-ND
C2	0.033μF	399-C0603C333J5RAC7867TR-ND
C3	330pF	399-C0603C331J5RAC7867TR-ND
U$1	battery holder	2057-BH-80A-1-ND
U$3	op amp	MCP6V12-E/MS-ND
U$4	op amp	MCP6V12-E/MS-ND
Sin	attaches to node 1 of sensor	
Sout	attaches to node 2 of sensor	

Pictures

Here is what the PCB looks like:

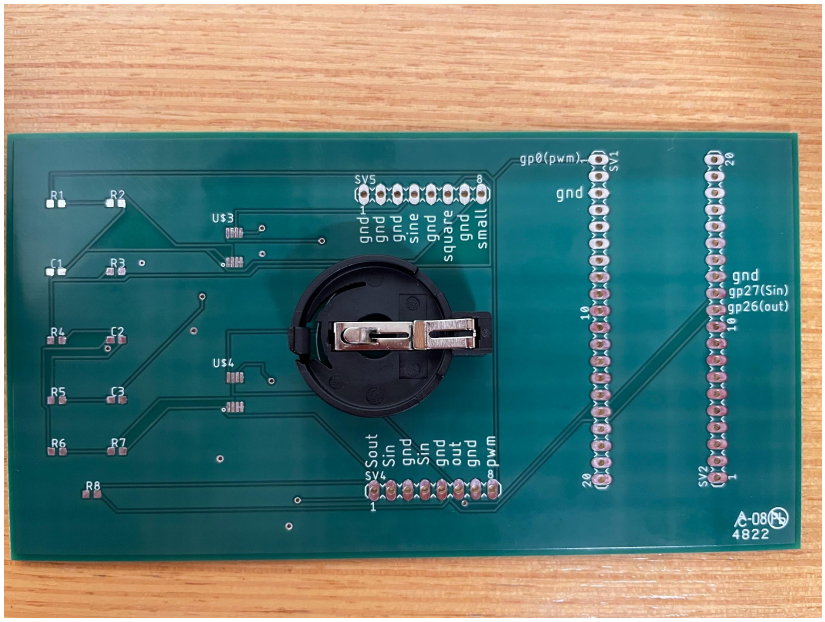


Here is how the raspberry pi pico fits on top:

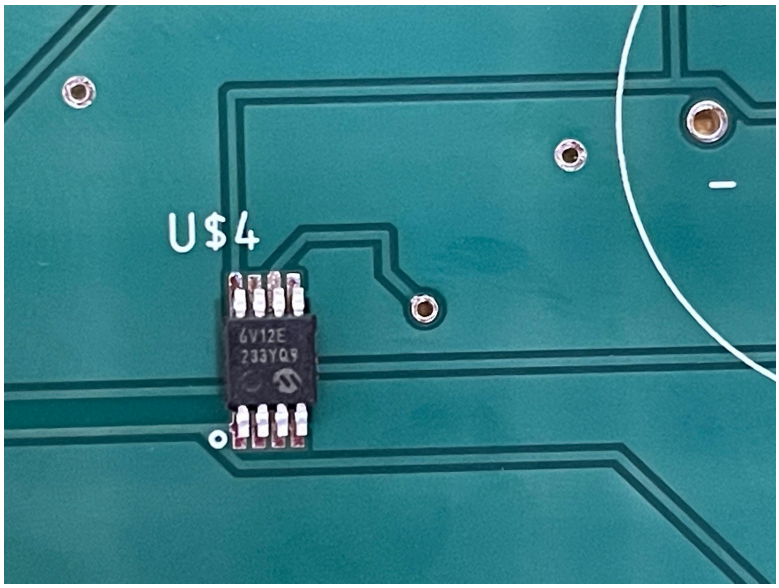


Simply attach by soldering pinheads to the through holes, as you would expect.

Here is how the batter holder fits on:

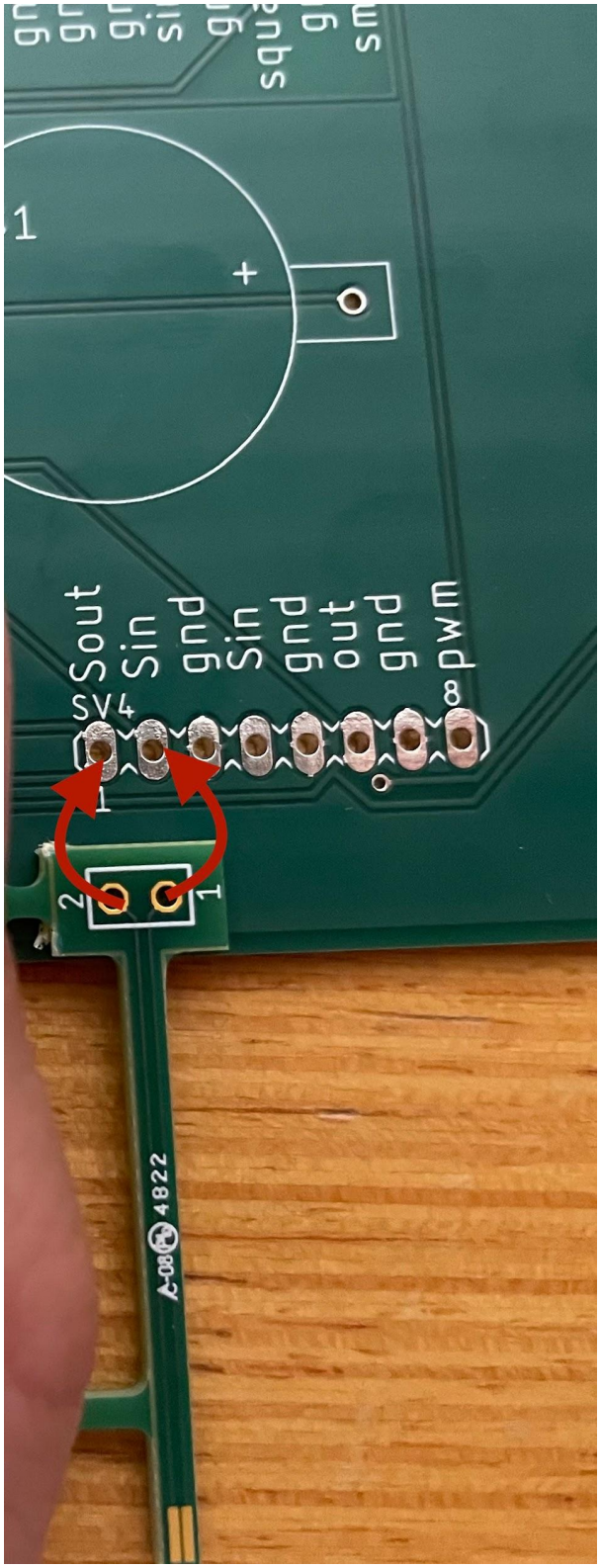


Here is how the op amp fits on:



Make sure that the black circle on the op amp is in the bottom left corner such that it matches up with that little white circle on the pcb.

Here is how the conductivity sensor attaches:



Basically a wire will connect “Sin” (sensor in) to node 1 of the sensor and “Sout” (sensor out) to node 2 of the sensor.