# Building your sEMG and ECG breadboard

Building the breadboard, high-level view

You will use the following components:

- Breadboard
- SparkFun AD8232 board
- Two 1.5V AA batteries
- Battery holder
- 3-electrode set with a TRS headphone plug
- Miscellaneous pieces of wire

You can find these somewhere in our lab – the final lab setup wasn't determined when I wrote this guide 😊. Because we're using a breadboard, there is no soldering involved.

Here is an overall schematic diagram of how you will interconnect the components:
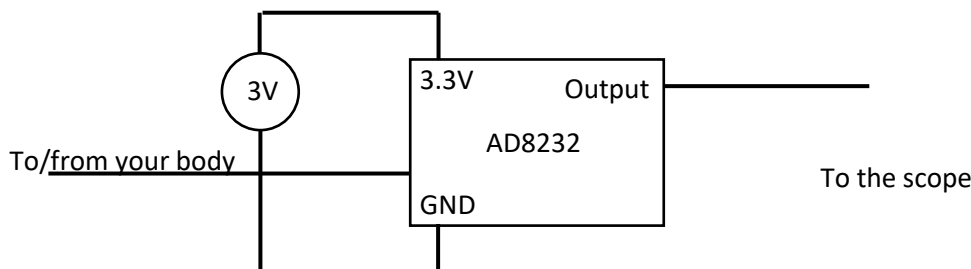
Your body's signals are quite low voltage and low power; the AD8232 board is largely a pre-amplifier that makes your body's signals strong enough to be easily displayed. The AD8232 needs battery power that is maximum 3.3V; a 3V battery works fine.

To give you some context, here's what the finished breadboard will look like:
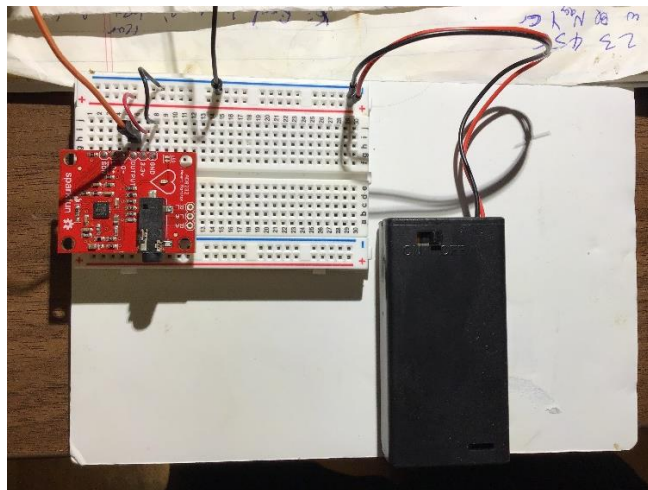
There's not really much to it. The big white mounting mounting board has the 3V battery pack and the breadboard mounted on it. The breadboard has our AD8232 board mounted on

it and a few wires for hookup. The orange and black wires that seem to go into outer space at the upper left of the picture are actually driving the scope.

While you're at it, the first thing you'll do is attach the battery holder and the breadboard to the plastic foam board. You should have some double-sided sticky foam things to do the attaching.

And that's the high-level view!

What is a breadboard, anyway?

The next question, perhaps: just what is a breadboard, anyway?


Here's a bit of breadboard info:
- The top two rows and the bottom two rows are special. The 25 holes on the top pin are all connected to each other and are meant to be ground (marked with a blue "-"); the 25 holes next row are all connected to each other and are meant to be power (+3V, marked with a red "+").
- If your eyes are good, you can see the two central grids (i.e., everything except those four special rows) labeled as rows a-j and colums 1-30. These two grids work by *columns*. Each column of 5 holes is all connected to each other (e.g., 3f, 3g, 3h, 3i and 3j are all connected to each other). But no 5-hole column is internally connected to any other 5-hole column (e.g., the 3f-3j group is *not* connected to the 3a-3e group, or to the 4f-4j group).
- We typically use red wires for power (i.e., our 3V wires), black wires for ground (0V), and any other color for signals. But this is just a convention – the electrons are color blind 😊.

Wiring the board

The next thing to do is stick the AD8232 board into the breadboard. Here's what the AD8232 looks like from underneath:
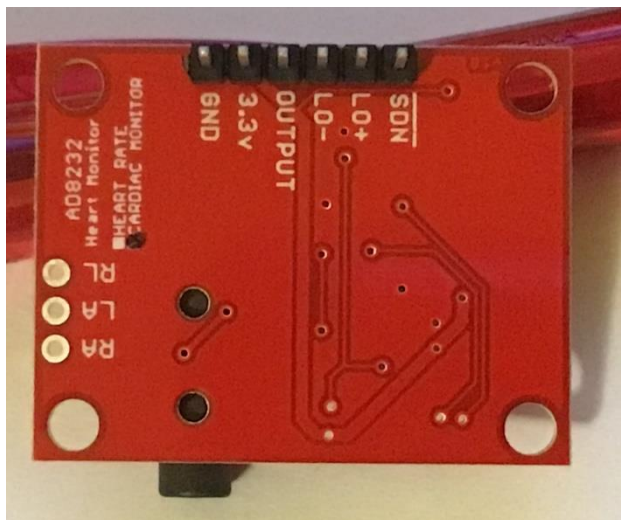
The AD8232 board has 6 pins sticking out from the bottom of the board, which go into breadboard row *f*, columns 3-8. Here's the breadboard with the AD8232 inserted and fully wired:
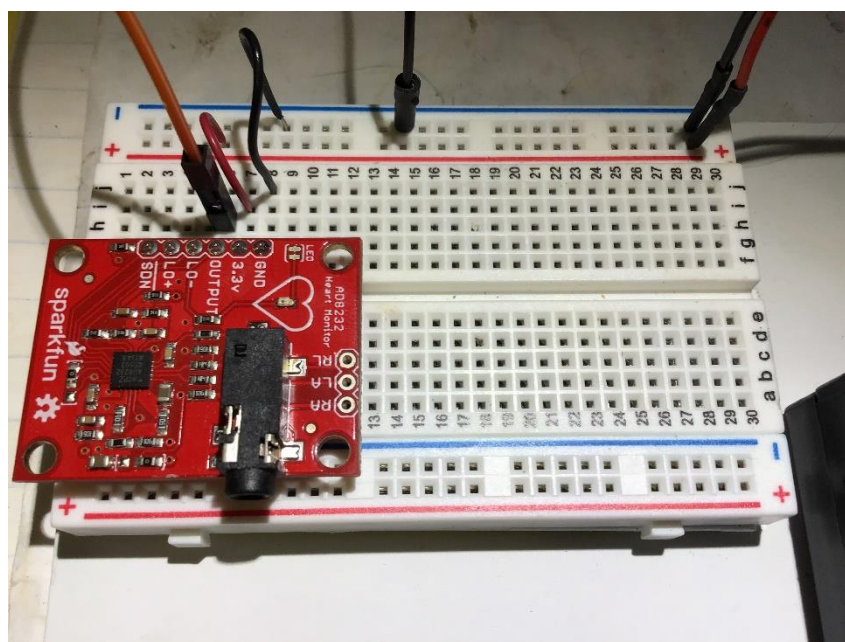
In the upper right, you can see the red and black wires (coming from the battery pack) driving 3V power and 0V ground into the breadboard.

In the upper left, you can see a short red wire (column 7) and a short black wire (column 8) driving power and ground from the breadboard to the AD8282 board. The trick here is that all five pins 7f-7j are internally connected together; you've driven power into 7i, and 7j connects to the AD8232 board's 3.3v pin.

There are only two wires left. You can see an orange wire attached to h6, which the AD8232's OUTPUT pin and which will drive the scope probe. You can also see a black wire attached to ground at about column 14, which will drive the scope ground.

That's it for the wiring!

The battery pack

A bit about the battery holder:
- if the batteries aren't already in it, you should put them in.
- the top slides off with a little bit of pressure. You don't have to push any buttons or releases to slide it off.
- It has an on-off switch. To the right is off, and left is on.

The electrodes

All that is left is to plug in the electrodes. This is the plug (whose tip is segmented into only three parts, and which already has long red, black and blue wires to the three electrodes:
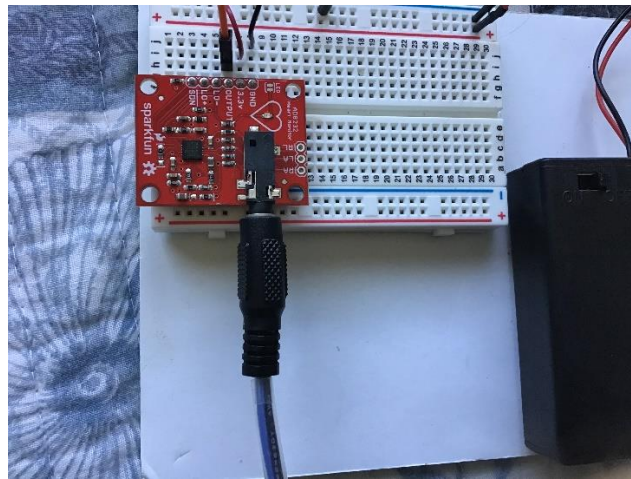
Note how tightly the plug fits into the socket. When you plug it in, be sure to support the AD8232 board with your fingers – the AD8232 board is attached to the breadboard with a few little pins that can easily break or bend if they're bearing any substantial force. If you don't push the plug in all the way, it might look like this:
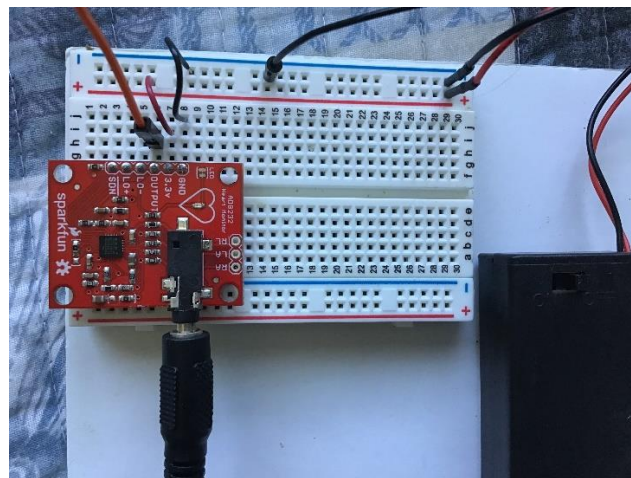
That would be bad! It's perhaps the most common reason for the breadboard to not work.

You're all done building the breadboard now! Next up – using the scope to look at its output.