IMPORTANT: The INA169 is configured to measure DC only. The VIN+ pin must be at a higher potential than the VIN- pin, which means that the INA169 cannot measure AC.

Measuring Current

The voltage at V_{OUT} can be measured using an oscilloscope or an analog-to-digital converter. A bit of math is needed to convert to the source current (I_S):

$$I_S = \frac{V_{OUT} \times 1k\Omega}{R_S \times R_L}$$

I_S is the current we want to measure.

V_{OUT} is the voltage we measured at the output of the INA169.

$1k\Omega$ is a constant resistance value we need to include due to the internals of the INA169.

R_S is the value of the shunt resistor. If you do not modify the board, then this is set at 10Ω.

R_L is the value of the output resistor. If you do not modify the board, then this is set at 10kΩ.

Example

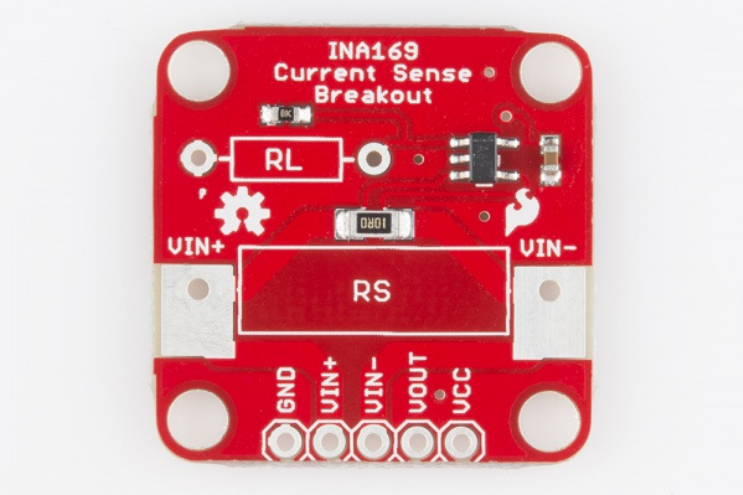
For example, let's say that you hook up the board and you measure 2.8V at V_{OUT}. Plugging this into our equation, we would get:

$$I_S = \frac{2.8V \times 1k\Omega}{10\Omega \times 10k\Omega} = 0.028A$$

This shows that you have 0.028A (or 28mA) flowing through your line.

The Pinout

There are only 5 pins on the breakout board.



GND should be connected to ground of the circuit you are trying to measure

VIN+ needs to be connected to the positive side of the source (e.g. battery, output pin, etc.)

VIN- needs to be connected to the positive side of the load (e.g. VCC on Arduino, positive side of an LED, etc.)

VOUT is the measured output and should be connected to something that measures voltage levels, such as a multimeter, oscilloscope, or an Arduino ADC pin

VCC is the supply power to the INA169, which needs to be connected to 3.3V, 5V, etc. This can be anywhere from 0 to 75V. Note that the V_{OUT} range depends on the voltage supplied by VCC.

In addition to the pins on VIN+ and VIN-, the board also has two large pads around R_S, which are capable of taking alligator clips should you want to have a temporary hookup. Note that GND and VCC will still need to be connected for the board to function.

Modifying Functionality

The INA169 cannot sense any differences across R_S greater than 500mV, and the output error increases once the voltage across R_S dips below 35mV. If you include the voltage drop across the internal transistor, this means that the default setup of the breakout board is limited to measuring a current range of about 3.5mA to 35mA.

If you would like to change that range, R_S and R_L can be replaced with resistors of different values. R_S can be removed and replaced with another resistor fairly easily. R_L is a bit more difficult as it is a small, surface mount resistor. Changing either of the resistors changes the equation from above.

With R_L at 10kΩ, changing R_S gives us the following ranges:

R_S	Current Sense Range
10Ω	3.5mA - 35mA
1Ω	35mA - 350mA
0.1Ω	350mA - 3.5A

IMPORTANT: Be careful with the power rating on the resistor! If you choose a 0.1Ω resistor for R_S and expect to see 3.5A through it, this can result in 1.2W of heat being generated - way too much for your average ¼W resistor! You will need a resistor that can handle at least 2W. The following power resistors are recommended:

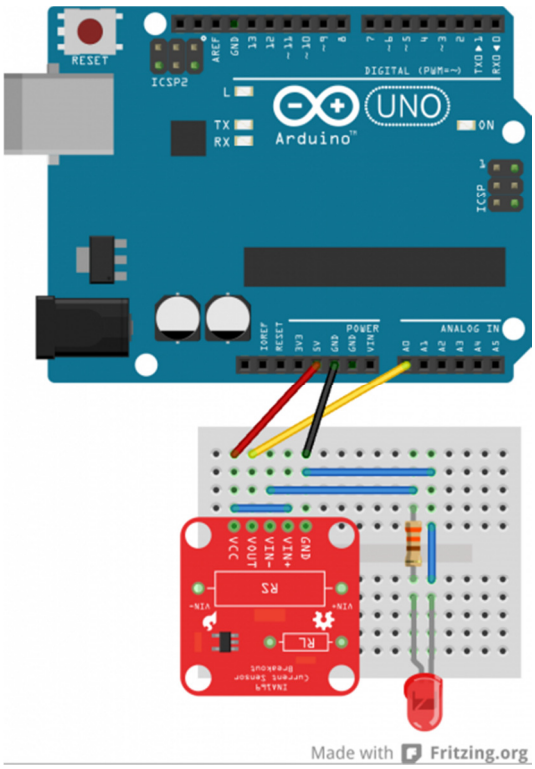
- Ohmite 1Ω 1% 3W
- Ohmite 0.1Ω 1% 3W

Hookup Example

Assembly

You will need to solder either wires or straight male headers to the 5 header holes on the board. If you need to measure over 35mA, you will need to desolder the RS resistor and solder a lower value (e.g. 1Ω), higher power (e.g. 3W) resistor to the holes around RS.

Connecting the INA169 Breakout Board



Fritzing of the INA169 connected to an Arduino

As shown in the diagram, connect the Arduino 5V to the INA169 VCC and the Arduino GND to the INA169 GND. To read the output voltage level, we need to run a jumper cable from the Arduino A0 to the INA169 VOUT pin.

Use a jumper wire to connect the INA169 VCC and VIN+ pins, as we want to power the LED with the Arduino 5V. If you use a different power source (other than the Arduino 5V or 3.3V) through VIN+ and VIN-, make sure you connect the ground of the power source to the ground of the INA169 board. Just ensure that the voltage level as measured from VIN+ to ground does not exceed 60V. Bad things will happen to the board if you do.

Connect a 330Ω resistor from the INA169 VIN- to the anode of the LED and a jumper wire from the LED's cathode to GND.

If you want to measure the current going to something else, you can use alligator clips on the bare metal pads around RS. Make sure that the INA169 board is inline with the positive power rail and that the INA169 GND is connected to the target's GND.