

# Three-lead Differential Muscle/Electromyography Sensor for Microcontroller Applications

## FEATURES

- Small Form Factor (1inch X 1inch)
- Specially Designed For Microcontrollers
- Adjustable Gain – Improved Ruggedness
- New On-board 3.5mm Cable Port
- Pins Fit Easily on Standard Breadboards

## APPLICATIONS

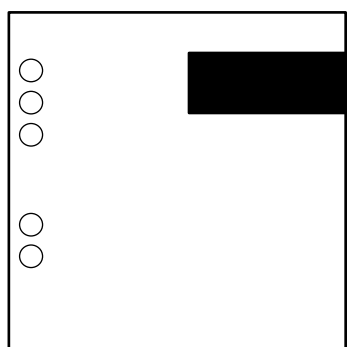
- Video games
- Robots
- Medical Devices
- Wearable/Mobile Electronics
- Powered Exoskeleton suits

## What is electromyography?

Measuring muscle activation via electric potential, referred to as electromyography (EMG), has traditionally been used for medical research and diagnosis of neuromuscular disorders. However, with the advent of ever shrinking yet more powerful microcontrollers and integrated circuits, EMG circuits and sensors have found their way into prosthetics, robotics and other control systems.

## PIN LAYOUT

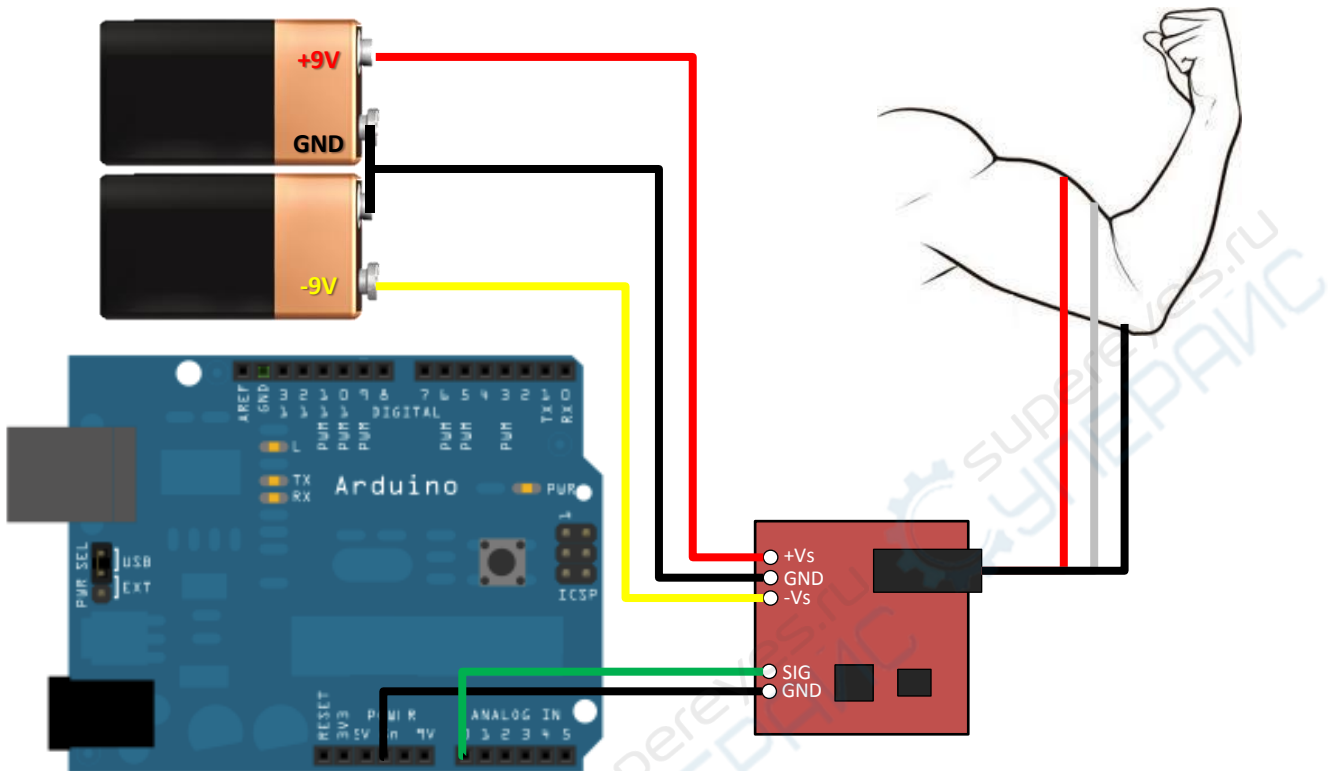
- Power Supply, +Vs – 5
- Power Supply, GND – 4
- Power Supply, -Vs – 3
  
- Output Signal, SIG – 2
- GND – 1



3.5mm Cable Port



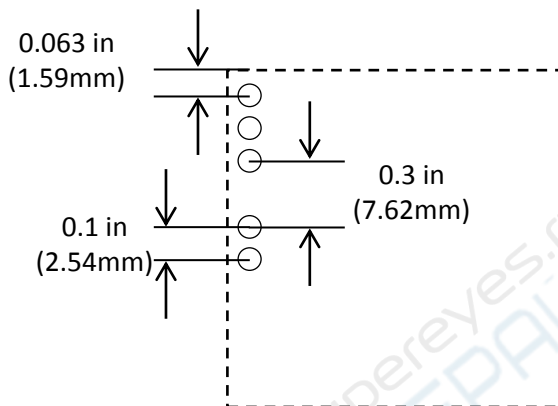
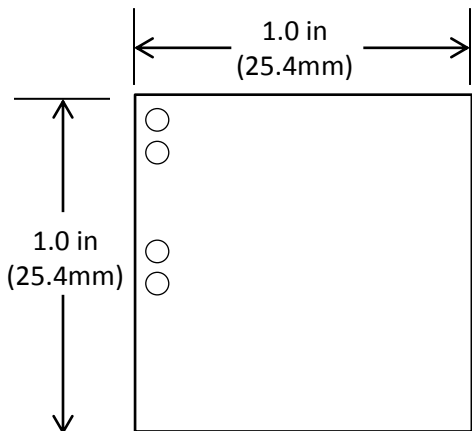
## Getting Started Using Two 9V Batteries



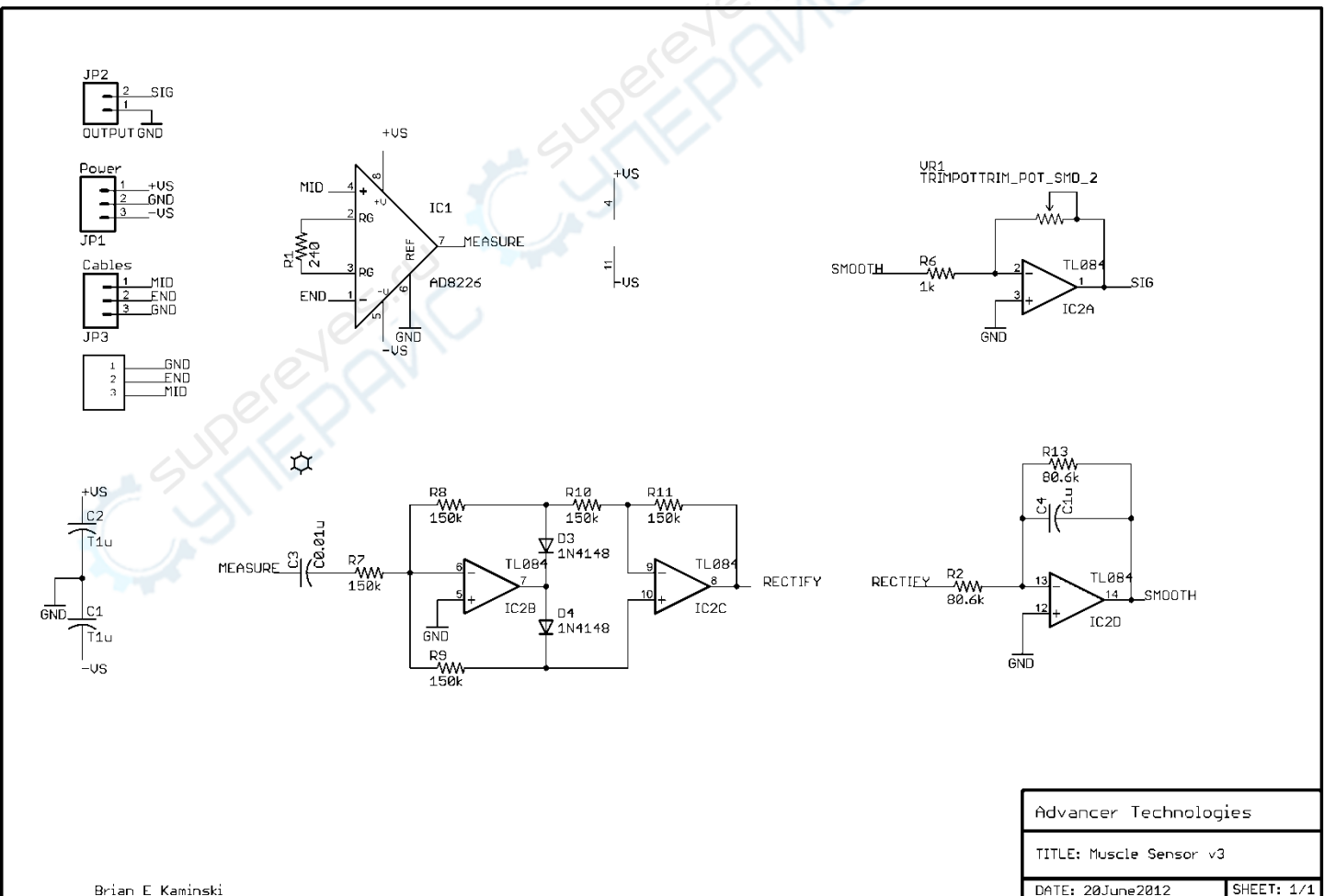
- 1) Connect the power supply (two 9V batteries)
  - a. Connect the positive terminal of the first 9V battery to the +Vs pin on your sensor.
  - b. Connect the negative terminal of the first 9V battery to the positive terminal of the second 9V battery. Then connect to the GND pin on your sensor.
  - c. Connect the negative terminal of the second 9V battery to the -Vs pin of your sensor.
- 2) Connect the electrodes
  - a. After determining which muscle group you want to target (e.g. bicep, forearm, calf), clean the skin thoroughly.
  - b. Place one electrode in the middle of the muscle body, connect this electrode to the RED Cable's snap connector.
  - c. Place a second electrode at one end of the muscle body, connect this electrode to the Blue Cable's snap connector.
  - d. Place a third electrode on a bony or non-muscular part of your body near the targeted muscle, connect this electrode to the Black Cable's snap connector.
- 3) Connect to a Microcontroller (e.g. Arduino)
  - a. Connect the SIG pin of your sensor to an analog pin on the Arduino (e.g. A0)
  - b. Connect the GND pin of your sensor to a GND pin on the Arduino.



## Dimensions



## Circuit Schematic



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TITLE: Muscle Sensor v3

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SHEET: 1/1



## Electrical Specifications

Parameter	Min	TYP	Max
Power Supply Voltage (Vs)	±3.5V	±5V	±18V
Gain Setting, Gain = $207 \cdot (X / 1 \text{ k}\Omega)$	0.01 $\Omega$ (0.002x)	50 k $\Omega$ (10,350x)	100 k $\Omega$ (20,700x)
Output Signal Voltage (Rectified & Smoothed)	0V	--	+Vs
Differential Input Voltage	0 mV	2-5mV	+Vs/Gain



### ELECTROSTATIC DISCHARGE SENSITIVITY

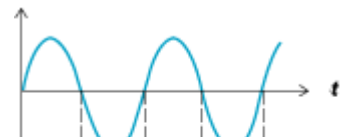
This sensor can be damaged by ESD. Advancer Technologies recommends that all sensors be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure.

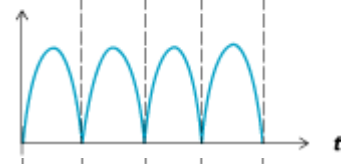
## RAW EMG vs Rectified & Smoothed EMG

Our Muscle Sensors are designed to be used directly with a microcontroller. Therefore, our sensors do not output a RAW EMG signal but rather an amplified, rectified, and smoothed signal that will work well with a microcontroller's analog-to-digital converter (ADC). This difference can be illustrated by using a simple sine wave as an example.

RAW Sine Wave



Full Wave Rectified Sine Wave



Rectified & Smoothed Sine Wave

