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MyoWare Muscle Sensor Kit

Introduction

As announced previously, Advancer Technologies started a Kickstarter campaign to produce an updated version of their Muscle Sensor v3 board. The MyoWare™ Muscle Sensor (AT-04-001) is the latest electromyography (EMG) sensor from Advancer Technologies. Here is an overview of the MyoWare product line and how to use it.



Figure 1. MyoWare main sensor board

MyoWare Muscle Sensor

A new version means new features. Here is a breakdown of the new features added to the MyoWare Muscle Sensor Board:

Single-supply — MyoWare won't need \pm voltage power supplies! Unlike the previous sensor, it can now be plugged directly into 3.3V - 5V development boards.

Embedded Electrode Connectors — Electrodes now snap directly to MyoWare, getting rid of those pesky cables and making the MyoWare wearable!

RAW EMG Output — A popular request from grad students, the MyoWare now has a secondary output of the RAW EMG waveform.

Polarity Protected Power Pins — The #1 customer request was to add some protection so the sensor chips don't burn out when the power is accidentally connected backwards.

ON/OFF Switch — Speaking of burning out the board, Advancer Technologies also added an on-board power switch so you can test your power connections more easily. It's also handy for saving power.

LED Indicators — Advancer Technologies added two on-board LEDs one to let you know when the MyoWare's power is on and the other will brighten when your muscle flexes.

For more information, please have a look at the official MyoWare Muscle Sensor datasheet.

What is electromyography (EMG)?

An EMG is used to record (graph) the electrical activity (electro) of muscles (myo).

Embedded Electrode Connectors

The embedded electrode connectors allow you to stick the board right to the target muscle and avoid the hassle of wires.

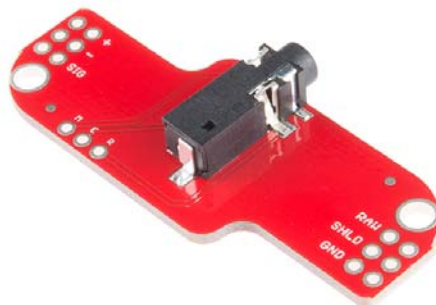


Embedded electrode connectors

The embedded snap connectors mate well with our Biomedical Sensor Pad (10 pack).

Cable Shield

There may still be cases where you want to mount the sensor pads away from the other hardware. For these cases, we sell the MyoWare Cable Shield.



MyoWare Cable Shield

The cable shield provides a jack where you can attach the three electrode cable shown here.



Three electrode cable

Instead of attaching the sensor pads to the MyoWare Muscle Sensor, attach them to the end of the cable. Both sets of contacts are connected, so make sure to only use one pad for each (Reference, End, and Middle).

Power Shield



MyoWare Power Shield

The MyoWare Power Shield is designed to take two coin cell batteries such as some standard CR2032s. They are connected in parallel for extended capacity at a nominal 3.0V. One thing to note is that due to the size of the batteries, the remote cable header can't be passed through. If you need access to these connections, this Power Shield must be stacked above the board(s) that need access.

Battery power allows for a cleaner signal and also eliminates the possibility of creating a dangerous current path to the power grid.

Proto Shield



MyoWare prototyping shield

The MyoWare Proto Shield passes all signals to a bit of protoboard. Use this area to solder on whatever custom circuitry you can come up with.

The Cable Shield and the Proto Shield have two rows of 3-pin plated through holes on each end. This allows 'standard' 0.1" headers to be used to stack them with other boards. Use the outer rows to connect to the Muscle Sensor, connect these two boards with the inner rows. The outer row on the top can also be used to stack another shield on top for a total of 4 boards in a stack.

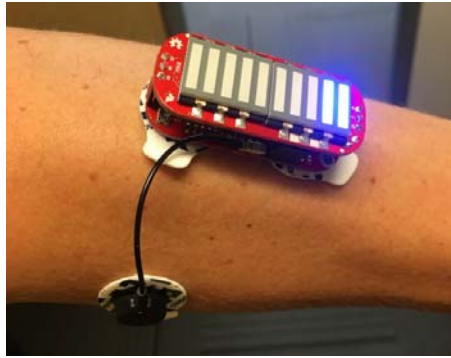
LED Shield

For those users looking for a large display of the signal level, we offer the the MyoWare LED Shield.



MyoWare LED Shield

The LED shield provides a large 10-segment bar graph corresponding to the level of the muscle signal measured. This shield is likely to be the top board in a stack. Solder on some 1x3 male headers, and plug it into the sensor board. The power is supplied on the LED shield, but controlled by the power switch on the sensor. Once the stack is assembled, snap on some electrodes, and stick the sensor on the target muscle.



MyoWare LED Shield on an arm

The more muscle activation measured, the higher up the board the lit LEDs will go. In the image above, the two segments near the 'MIN' label are lit, and, if the voltage measured were to increase, the segments to the left would begin to light until the last one labeled 'MAX' is reached. The LEDs are bright enough to be seen in full light, but really glow nice in low light.

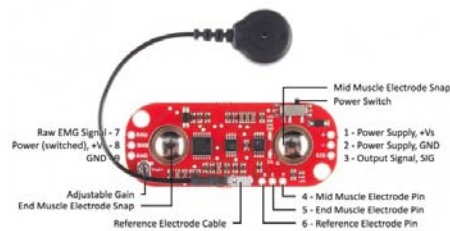


MyoWare LED Shield in the dark

Putting it All Together

As mentioned above, there are two ways to attach the sensor pads to a user. They can be attached directly to the sensor board, or to the the end of a cable via the MyoWare Cable Shield.

In the image below, the left most electrode connection should be connected to the muscle being measured. This is equivalent to using the red insulated conductor on the cable. The mid muscle electrode on the right breaks out on the black snap. The reference electrode has continuity with the blue snap on the cable.



MyoWare sensor layout

As shown in the image above, there are three rows of three 0.1" spaced plated through holes. On the right is the power supply +Vs, & ground, along with the processed output signal (holes 1, 2, & 3).

Along the long edge near the mid muscle electrode snap are the thru-holes for remote electrode connection (holes 4, 5, & 6).

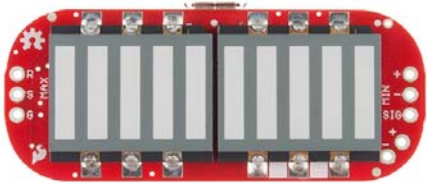
On the opposite end are three 'outputs'. Hole 7 is the raw, unprocessed EMG signal. Hole 8 is the switched power. Power goes into the board via hole 1, is switched, and comes back out hole 8 (if you believe in passive sign convention (PSC)). Hole 9 is the ground reference for the switched power.

The shields come with assorted support for these pins. Some shields such as the Power Shield don't support the remote connections. If you need access to these pins the boards that use or can pass them through must go lower in the stack. Both the Cable Shield and the Proto Shield have this connection capability.

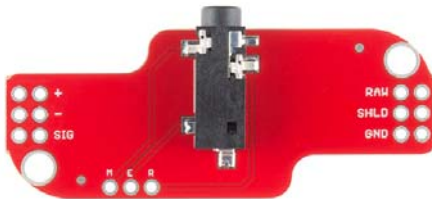
Danger! The power shield and the LED shield both provide power, but at slightly different voltages. Don't use both of these shields at the same time.



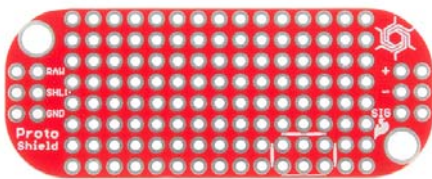
MyoWare Power Shield (top view)



MyoWare LED Shield (top view)



MyoWare Cable Shield (bottom view)



MyoWare Proto Shield (top view)

Take note of the second row of holes on the Cable and Proto shields. This allows for stacking multiple shields using standard 0.1" headers or the stackable variety.



Break Away Headers - Straight

© PRT-00116

Female Headers

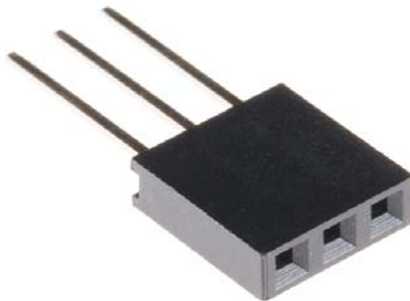
© PRT-00115

**Stackable Header - 3 Pin (Female, 0.1")**

© PRT-13875

The MyoWare sensor should be populated with female headers. If using the stackable headers supplied with the kit, it is likely that you will want to flush cut the long leads from the bottom. It's possible to use a setup including the cable shield, where you might want to leave them, so we've given that option. The shield desired to mate with the MyoWare sensor should in most cases have male headers populated on the outer bottom rows to mate with the female headers. If using the parts provided on the kit, these male headers will likely be the bottom half of stackable headers. The top side of this shield can then be populated with female headers. The next board in the stack will then need male headers on the bottom inside. This shield can have female headers mounted to the outside row on the top side.

To make stacking easier, the MyoWare Muscle Sensor Kit includes 3-pin stackable headers. Using these on all of the shields allows for easy stacking in more configurations. *Note: We have included three 1x3 male headers in the kit. The normal use case will be to put two of them on the LED shield, but some of you might want a clean top surface on the cable or proto shields so we threw in an extra one for this option.*



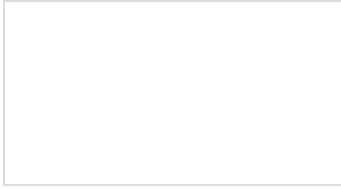
3 pin stackable header

Resources and Going Further

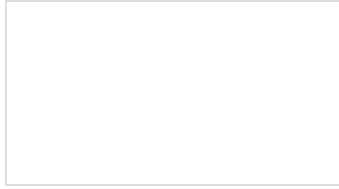
Thanks for reading. For more information on the MyoWare product line, please visit the following links.

- Official MyoWare™ datasheet

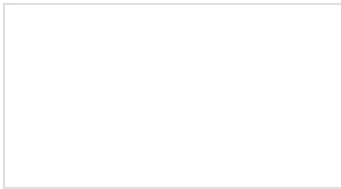
- [Advancer Technologies Website](#)
- [MyoWare GitHub Repository](#) For more cool projects and ideas, check out the following SparkFun tutorials.



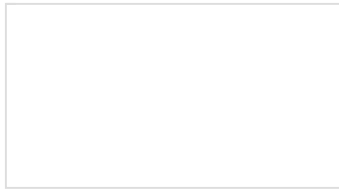
Hackers in Residence - Hacking MindWave Mobile
Review, teardown, and hacking tutorial for the MindWave Mobile, a \$99 commercial grade EEG sensor.



AD8232 Heart Rate Monitor Hookup Guide
Learn how to create your very own heart rate monitor.



MyoWare Muscle Sensor Kit
Line of products to work with the MyoWare muscle sensor from Advancer Technologies



MAX30105 Particle and Pulse Ox Sensor Hookup Guide
The SparkFun MAX30105 Particle Sensor is a flexible and powerful sensor enabling sensing of distance, heart rate, particle detection, even the blinking of an eye. Get ready. Set. Shine!