Bambot
Electronics Guide

Helpful notes for electronics components - JUN 2018

M5Stack - ESP32 powered

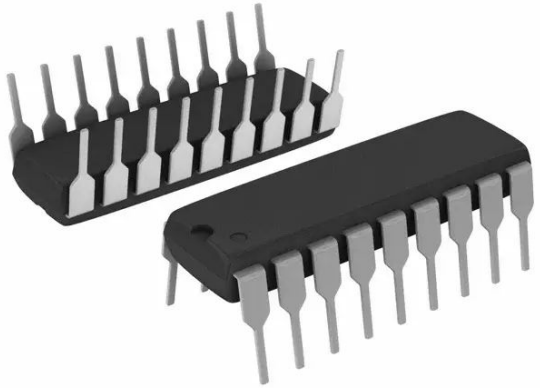
Powerful Internet of Things capable Bambot controller...

- Compatible with Arduino, MicroPython, Espruino, PlatformIO, and more...you have options
- Very handy full color screen and input buttons
- Program and charge via USB C (cable included)
- Power button - Single press on, Double press off

Resources:

- Documentation
- M5Stack GitHub
- Image to C array converter (turn .bmp files to .c files that you can load via Arduino IDE or others)

MCP23008 Digital I/O Port Expander

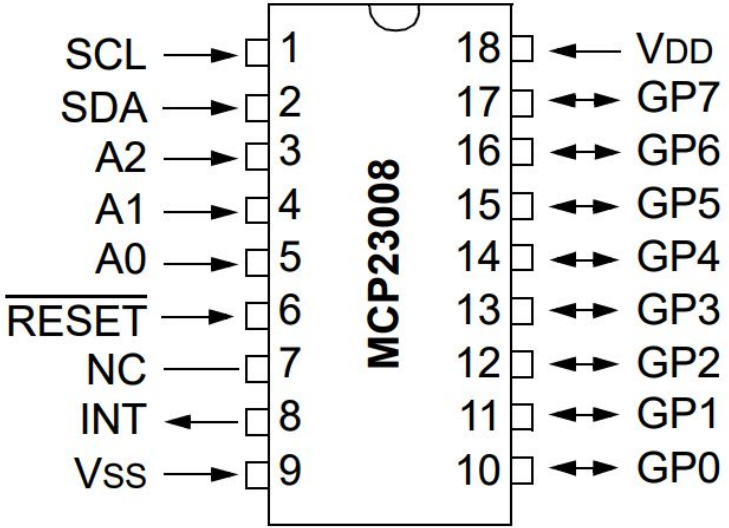


Get 8 more Digital I/O ports via I2C

- Connect to pins 21 and 22 on the M5Stack
- Allows 8 more digital I/O pins for your bot
- Advanced users can implement interrupt functionality from MCP23008

Resources:

- Datasheet
- Arduino Library from Adafruit



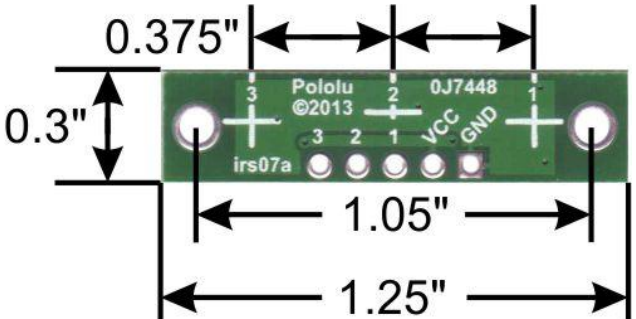
Pololu Reflectance Sensor

Great for line following

- Optimized for following black electrical tape lines on a light colored background
- Recommended for closed loop line following control using PID loop (really just PD in most cases).
- Connect with 5V, GND, and three digital I/O pins

Resources:

- Hardware: https://www.pololu.com/docs/0J13/all
- Library use: https://www.pololu.com/docs/0J19/all

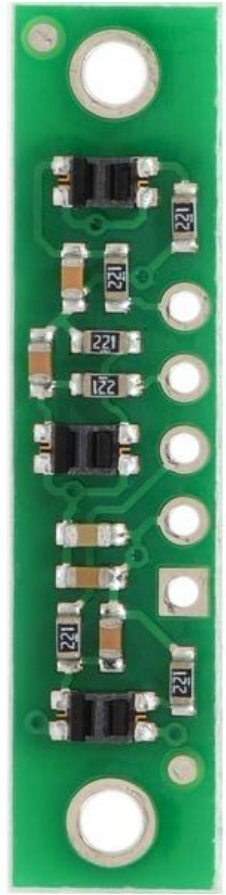


Pin Requirements:

- 3 Digital Inputs

MCP23008:

- May be possible, but only if the library is modified



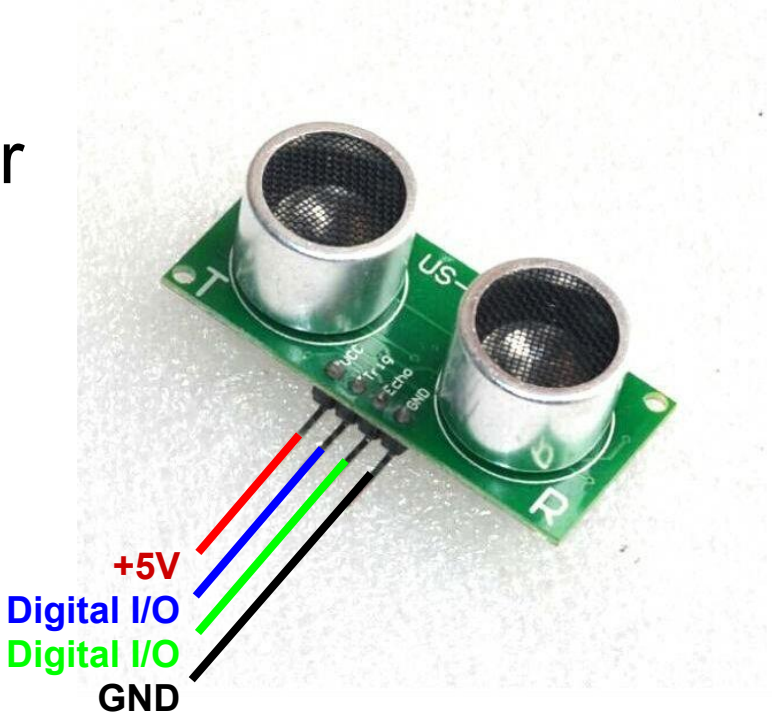
US-015 Ultrasonic Range Finder

Uses ultrasonic sound pulses to determine distance (not direction) of an object.

- Determines distance from time it takes for sound to bounce back to sensor
- Some objects may be hard to detect if they don't adequately reflect ultrasonic sound
- Many good libraries and example code
- Digital I/O pins for Trig and Echo can optionally be connected to a single Digital I/O pin.

Resources:

- http://playground.arduino.cc/Code/NewPing



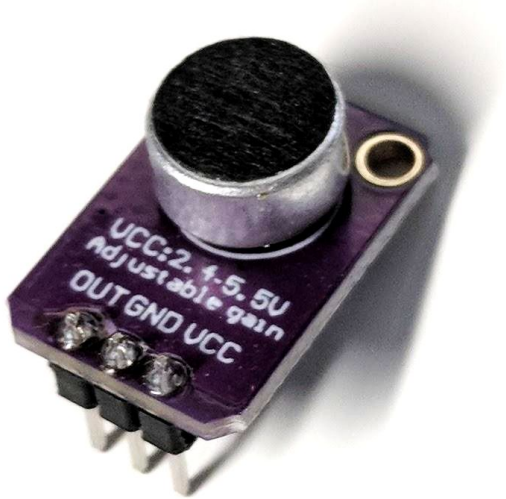
Pin Requirements:

- 1 or 2 Inputs

MCP:

- Probably not possible

Microphone



Allow your bot to “hear” sound...

- Record and playback sound on the built-in speaker
- Have your bot respond to sound
- If you’re really ambitious, you could even connect with an IoT voice AI platform for true voice control over your bot...**hint:** check out Alexa Voice Service

Resources:

- Datasheet
- Adafruit Tutorial
- **Note:** This simple board is similar to Adafruit’s MAX4466 board. (but it is not a copy) Adafruit was out of stock or we would have supported them by purchasing their version.

Pin Requirements:

- 1 Analog to Digital converter

MCP:

- No

DC Gear Motors

Drives the Bambot Tracks

- Powered with 6V through the Pololu Motor Driver
- No Load - 550RPM, 100mA
- At Rated Load - 350RPM, 320mA, 4.2ozin (0.3kgcm)
- At Stall - 0RPM, 1.6A, 10ozin
- Includes a magnetic quadrature encoder

Motor Pin Requirements:

- 2 PWM outputs, 2 outputs

MCP:

- Can use MCP for direction pins but not speed

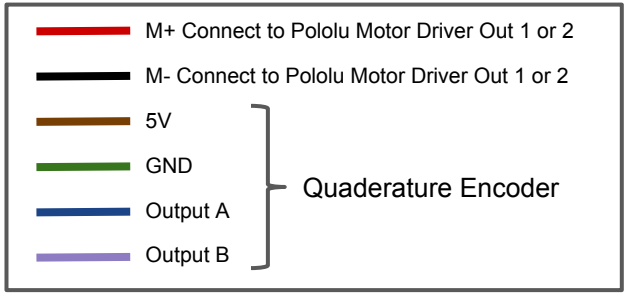
Encoder Pin Requirements:

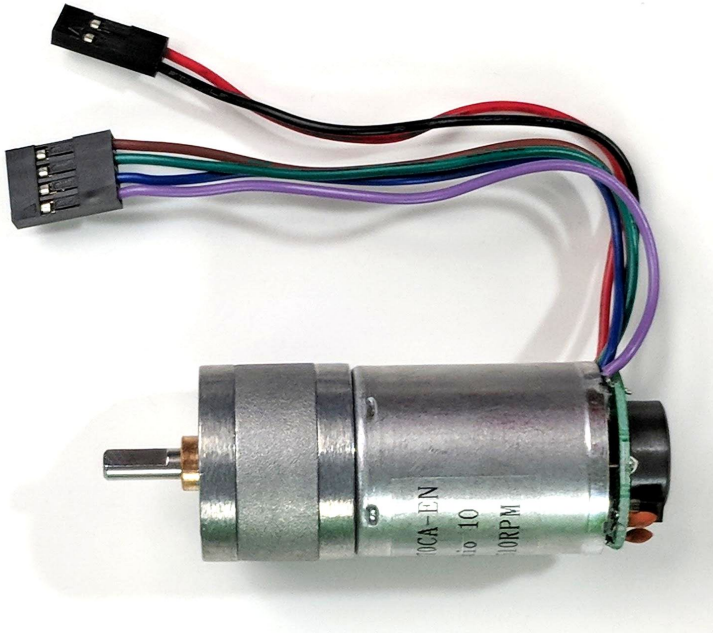
- 4 Inputs with interrupts

MCP:

- May be possible, but difficult to do and maintain accuracy

Wire Color Code





High-torque Hobby Servos

Turns to a position when you give it a command.

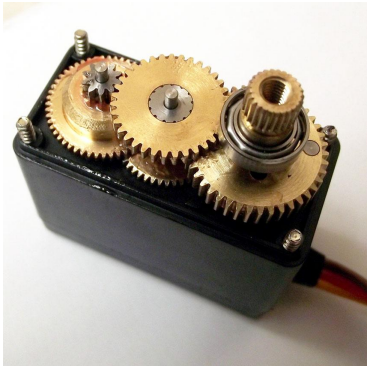
- Use it to move arms or other parts of your robot
- 180deg range of motion
- Higher torque than most other standard-size servos
- Needs a power system that can deliver 3A and handle high current spikes for aggressive movement (like the one in your Bambot)
- Power with 6V
- Drive it with a 50hz PWM signal - duty cycle controls angle

Pin Requirements:

- 1 PWM pin per servo (2 total)

MCP:

- No



Pololu Motor Driver

Drive motors with control signals from your M5Stack

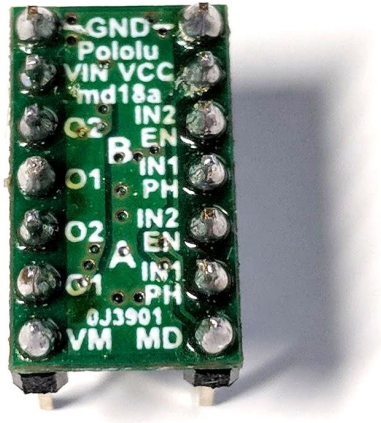
- Reliable with over-current and over-temp protection
- Well matched to your Bambot's motors
- Connect with 6V, GND, and four digital I/O pins

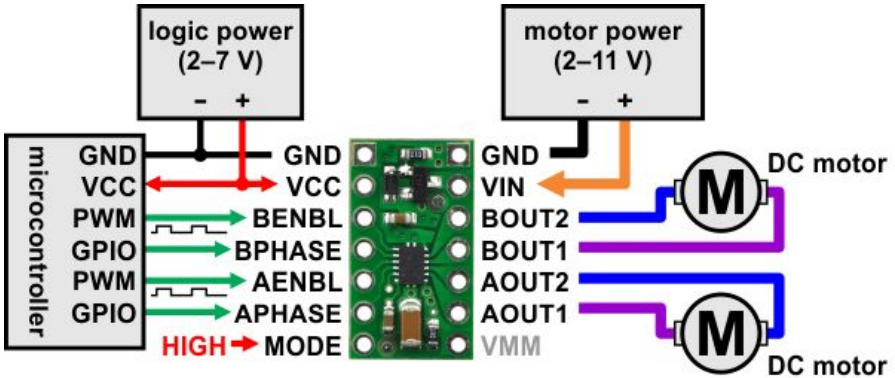
Resources:

- Hardware: https://www.pololu.com/product/2135
- Library use: https://github.com/pololu/drv8835-motor-shield
- Library included in Arduino Library Manager

Pin Requirements:

- See motor slide
- Optionally can use 1 Output (connected to MODE) to enable or disable motors in software





Note: This shows the bottom of the board so the connections are flipped left to right.

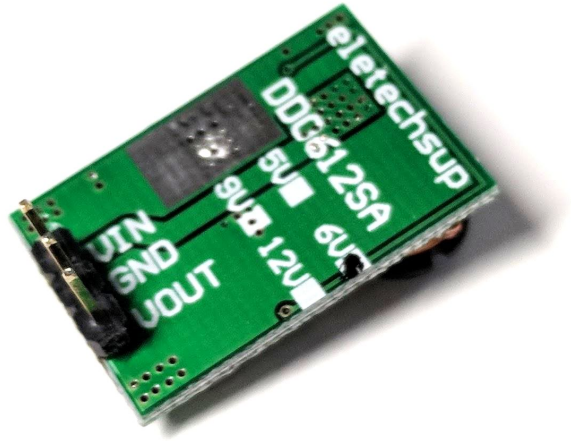
Voltage Boost Converter

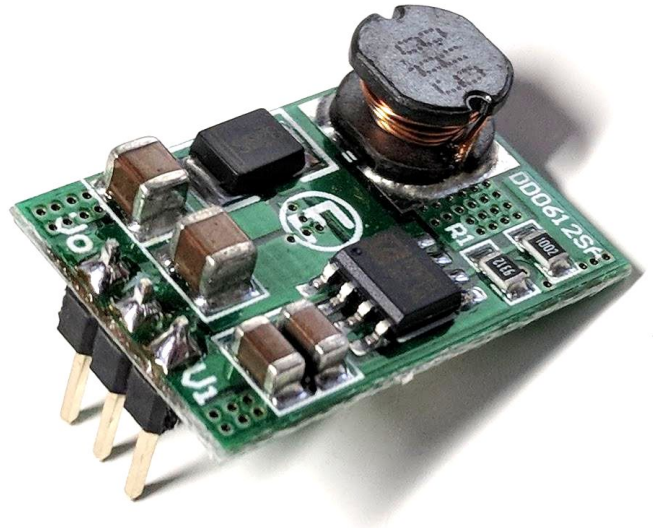
Boost voltage from battery up to 6V for motors and servos.

- Connect battery + to Vin and Battery - to Vout
- Use GND pin and Vout pin for regulated 6V
- Can provide up to 3A depending on input voltage
- Protected by thermal shutdown
- Will generate

Resources:

- Hardware: https://www.pololu.com/product/2135
- Library use: https://github.com/pololu/drv8835-motor-shield
- Library included in Arduino Library Manager

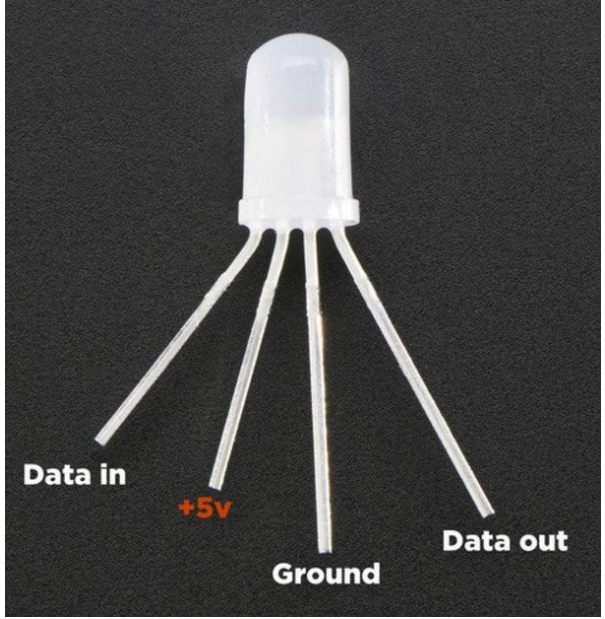




NeoPixel RGB LEDs

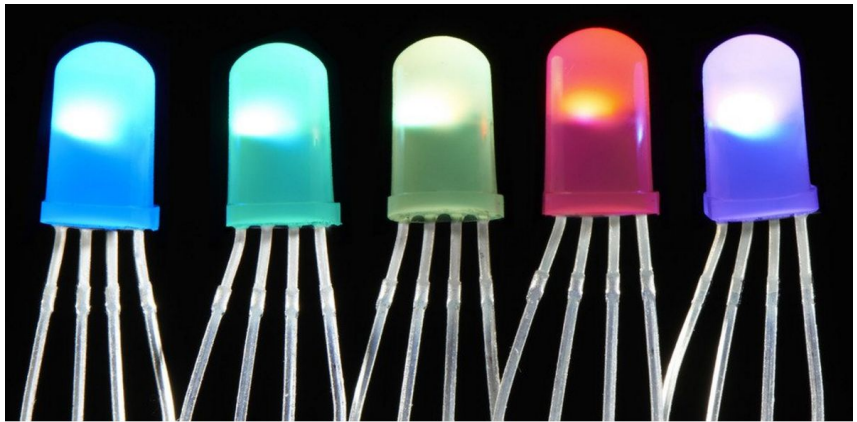
Multi-color and individually addressable!

- Chain them together and use one data pin to individually control them
- 24-bit color
- Use with 5V power and data



Resources:

- Adafruit product page
- Adafruit Library Installation and Use



Pin Requirements:

- 1 Output (for almost unlimited LEDs!)

MCP:

- No

Temperature Sensor (TMP-36)

Output voltage changes with temperature

- Measures temperatures from -40 to 125 degrees Celsius
- Operates from 2.7 to 5.5 Volts
- Returns an analog voltage

Resources:

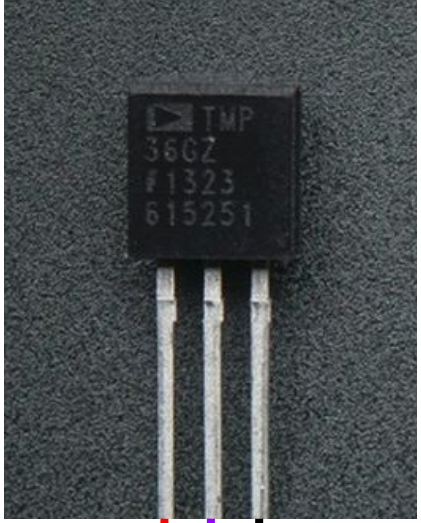
- Adafruit Tutorial with example code
- Datasheet

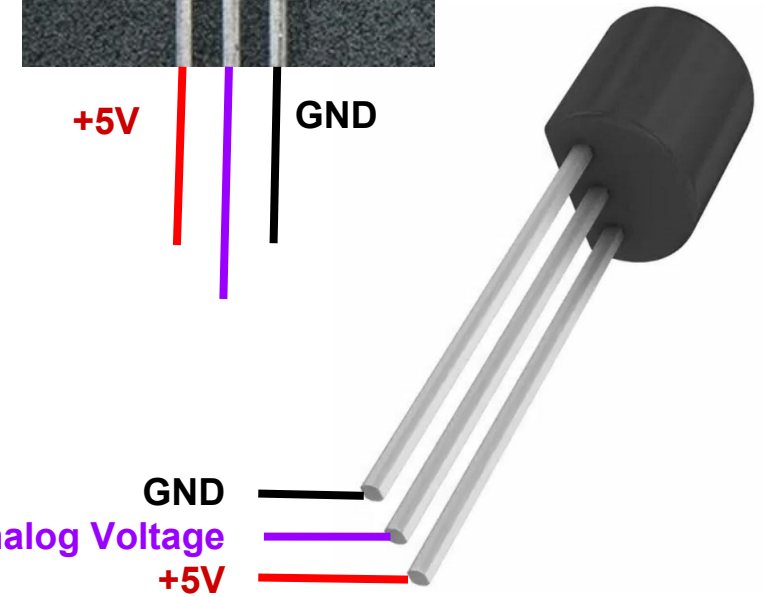
Pin Requirements:

- 1 Analog to Digital converter

MCP:

- No





SPDT Slide Switch

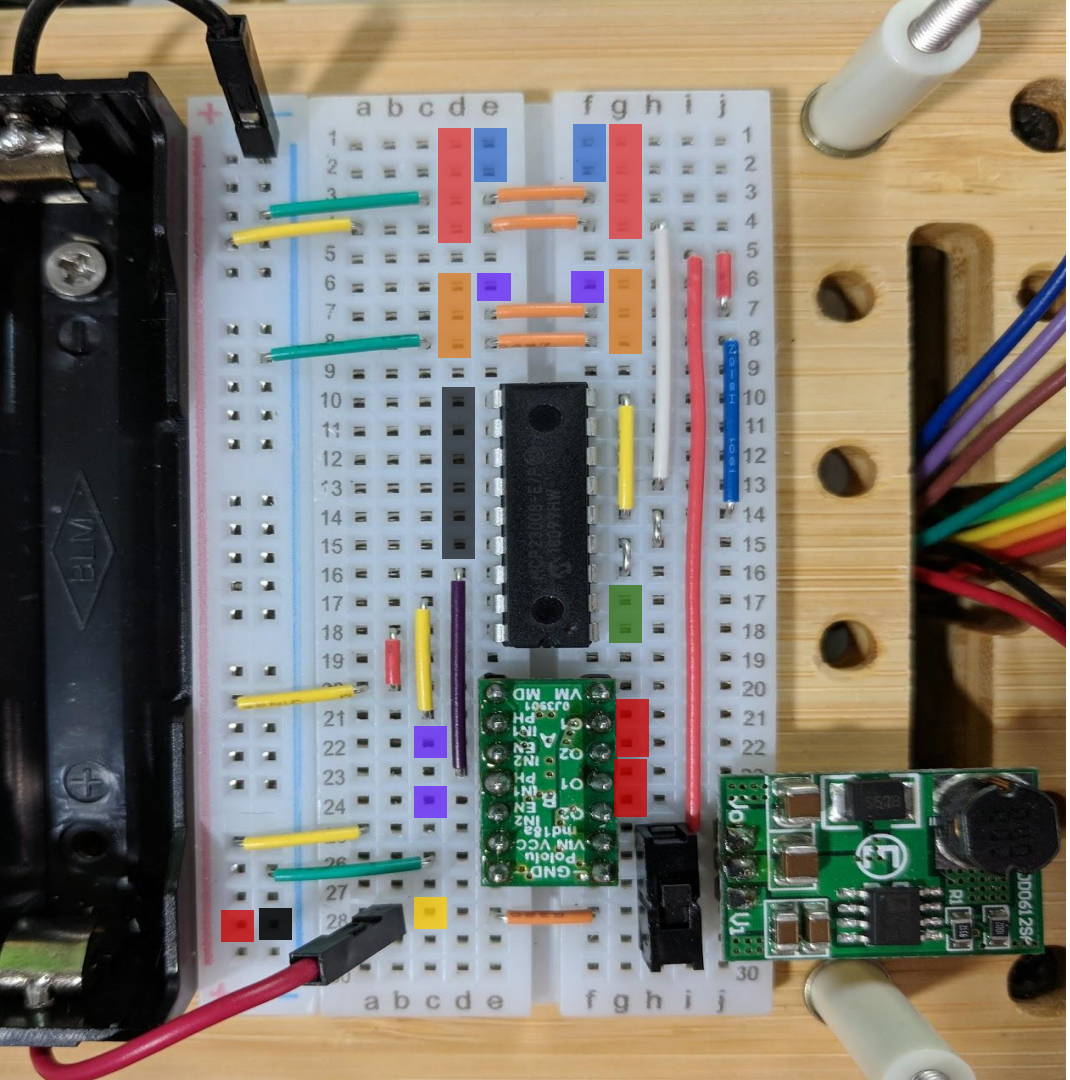
Can be used to physically turn on/off electrical components. (i.e. Motor Driver)

- Use to disable motors while programming, etc.
- Middle pin will be connected to one side pin at a time.
- Slide toward the pin you want connected to the center pin, the other pin will be disconnected.

Resources:

- Datasheet

SPDT Slide Switch Datasheet



Motor encoders (+5, G, A, B)

Servos (G, +6, Signal)

Motor encoder data pins

PWM pins on M5Stack

I2C Pins (SDA, SCL) on M5Stack

Digital I/O

Motor Power (Red/Black)

BAT on M5Stack

G on M5Stack

5V on M5Stack