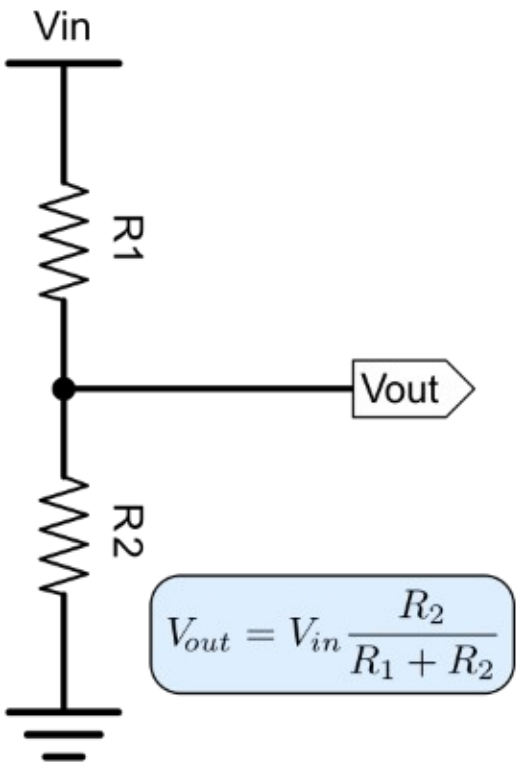
Advanced Adventures with Microcontrollers

Physical Computing and Rapid Prototyping for Artists

New Talents Ruhr, 2024 · Day 03 · Johannes Bereiter-Payr

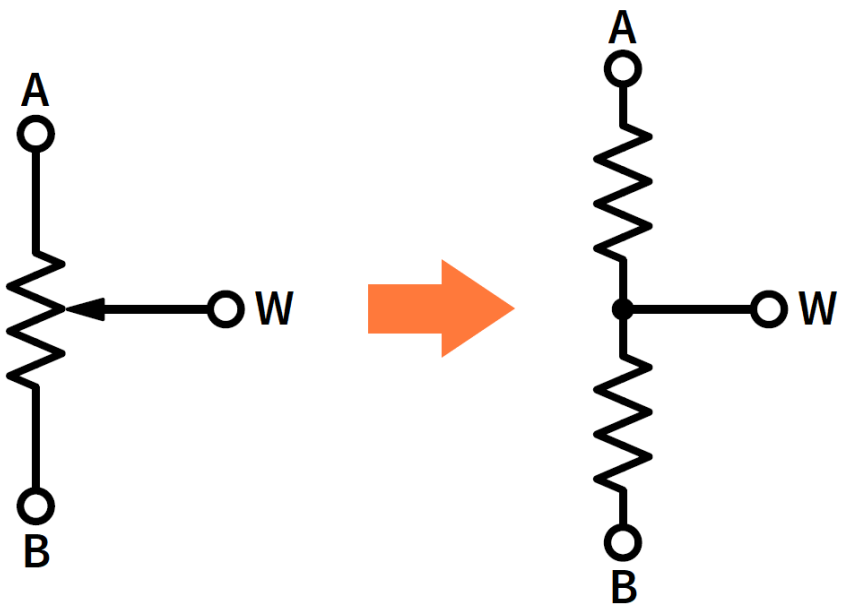
Analog Input

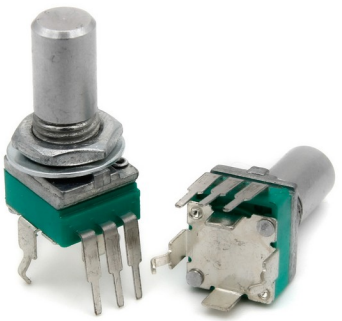
- Recap: Resistors
  - Basically a tight spot for electrons
- More Fun: voltage divider
  - Making it actually useful
- What if the values change?



Analog Input – There's a part for that

- Potentiometers = "Knobs"
- Like two resistors in one





Digital to Analog

- Voltage is translated into numbers
- 0..3,3 V → 0..255 or 0..1024

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n = analogRead(PIN);
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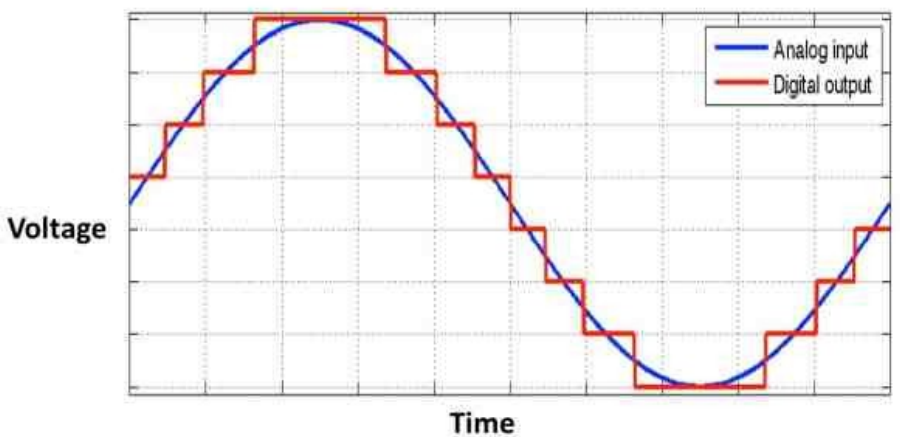
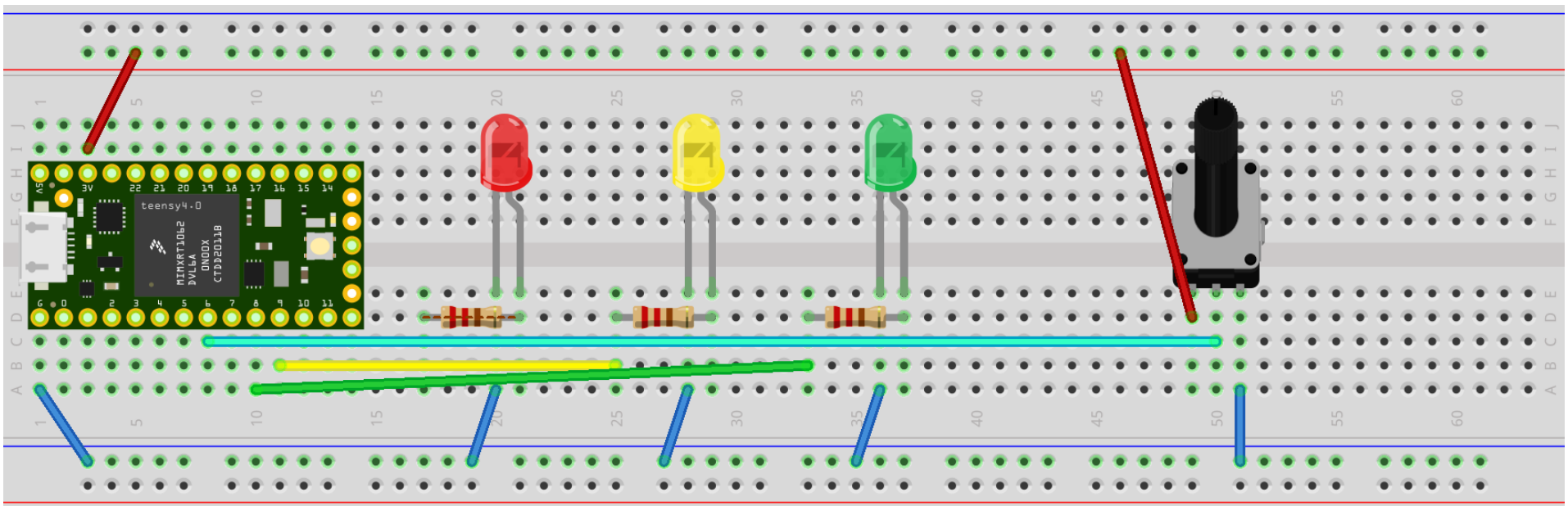


Reuse, Recycle



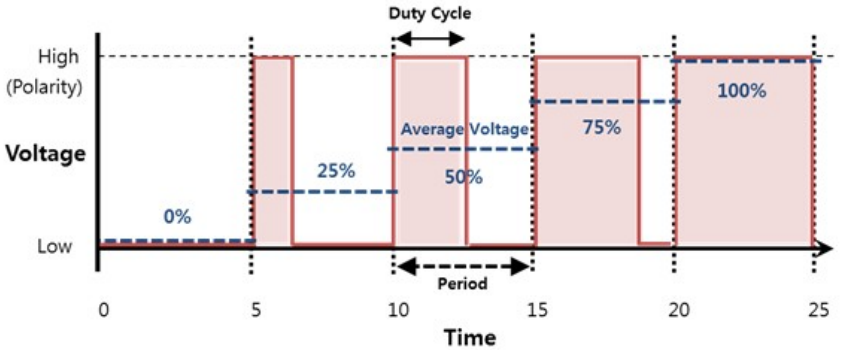
Analog Output and Sound

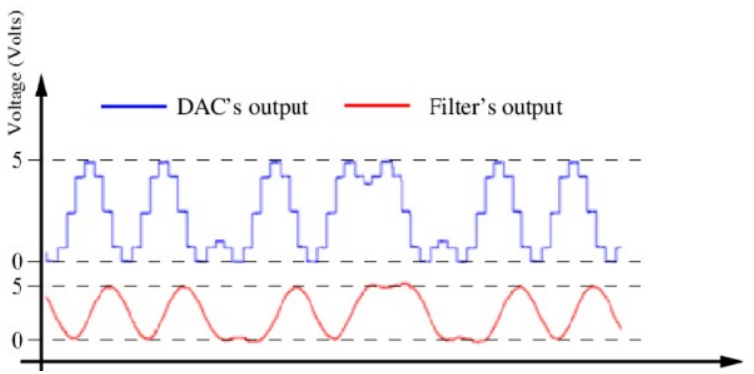
PWM
(pulse width modulation)

- Pulses have fixed amplitude and frequency, variable length

Audio
= Digital to Analog output

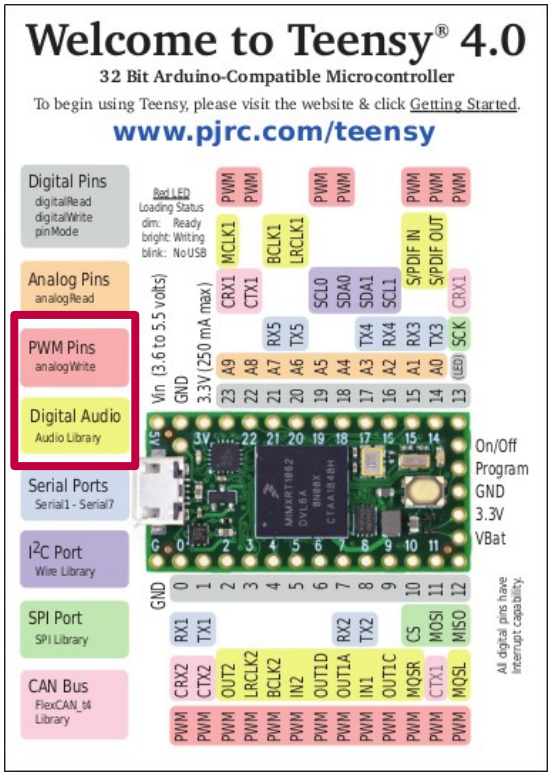
- Variable amplitude and frequency
- Needs special hardware





Not all Pins are equal

- PWM and Analog Out available on selected pins
- The practical postcard tells you where
- Digital audio still needs amplification
- PWM needs driver or filter



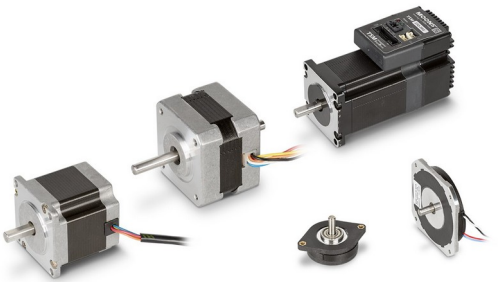
Human Device Interface

- Turn your microcontroller into a Keyboard or Mouse (or MIDI device, game controller, ...)
- Needs Arduino IDE to work with teensy

Motors, Servos, Steppers

- Fast
- No exact position control
- Powerful with gears

- Slow(ish)
- Relative position control
  (eg. 0..270°)
- Available in all power ratings

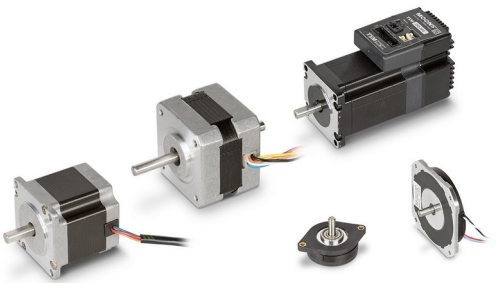


- Exact speed control
- Exact absolute position control (steps)
- Not very strong (usually)

Problem Solvers

- Direct drives (wheels, belts …)
- AC / brushless motors may be better (not covered)

- Steering in (R/C) vehicles
- Robots (some kinds)
- Kinetic sculptures



- CNC machines
- Robots (other kinds)
- Direct drives when torque can be low

Motor Drivers

- Servos have built-in driver and controller
- DC-Motors and steppers need drivers
- Driver =
  One-Way comunication →
  only half a controller
- Provides higher power and/or voltage
- Check the power rating matches your application!