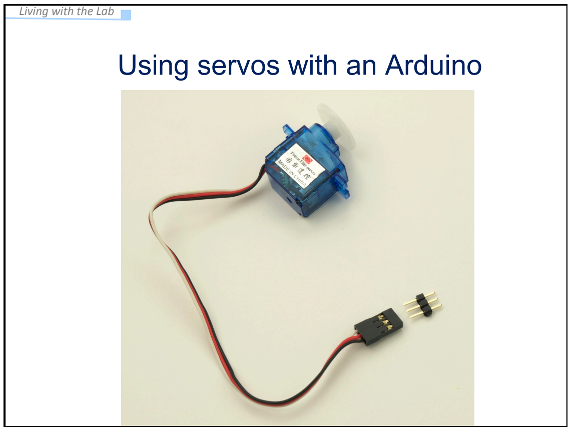

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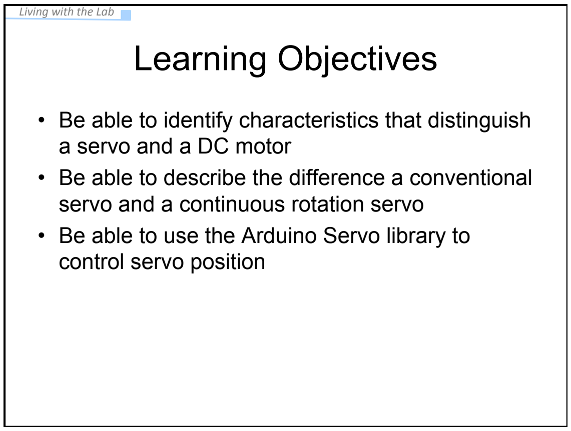
Using servos with an Arduino



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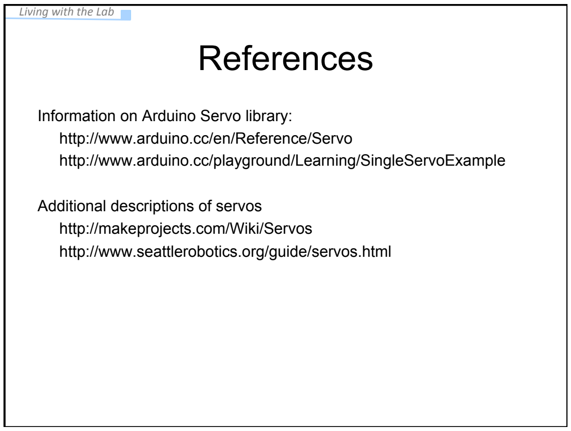
Learning Objectives

- Be able to identify characteristics that distinguish a servo and a DC motor
- Be able to describe the difference a conventional servo and a continuous rotation servo
- Be able to use the Arduino Servo library to control servo position



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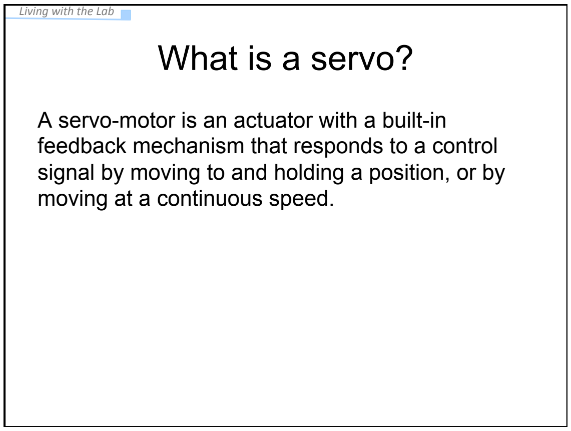
References

Information on Arduino Servo library:
http://www.arduino.cc/en/Reference/Servo
http://www.arduino.cc/playground/Learning/SingleServoExample

Additional descriptions of servos
http://makeprojects.com/Wiki/Servos
http://www.seattlerobotics.org/guide/servos.html



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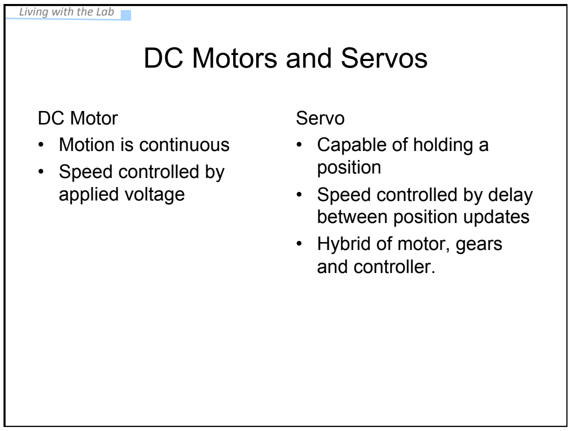
What is a servo?

A servo-motor is an actuator with a built-in feedback mechanism that responds to a control signal by moving to and holding a position, or by moving at a continuous speed.



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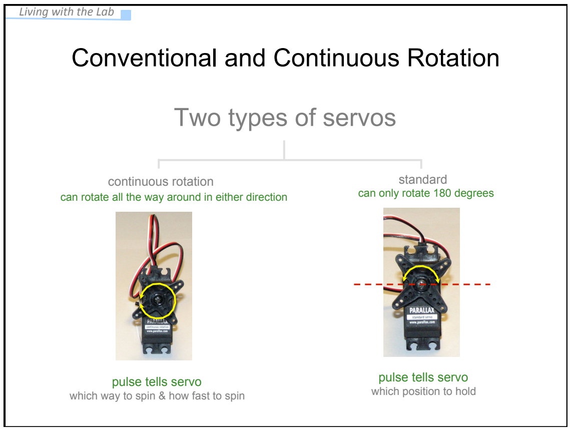
DC Motors and Servos

DC Motor

- Motion is continuous
- Speed controlled by applied voltage

Servo

- Capable of holding a position
- Speed controlled by delay between position updates
- Hybrid of motor, gears and controller.



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Conventional and Continuous Rotation

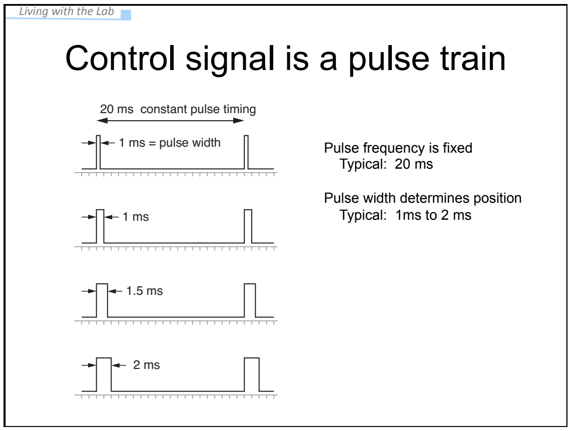
Two types of servos

continuous rotation
can rotate all the way around in either direction

pulse tells servo
which way to spin & how fast to spin

standard
can only rotate 180 degrees

pulse tells servo
which position to hold



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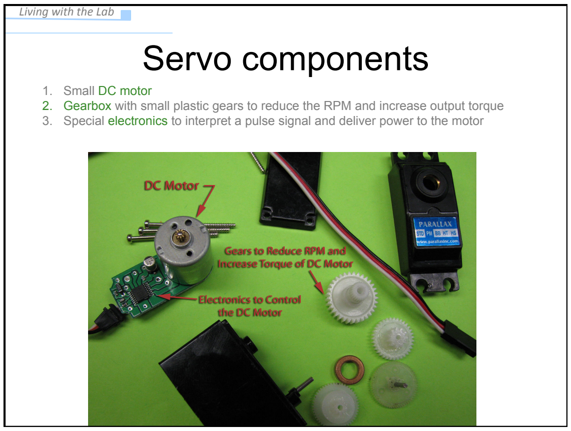
Control signal is a pulse train

Pulse frequency is fixed
Typical: 20 ms

Pulse width determines position
Typical: 1ms to 2 ms



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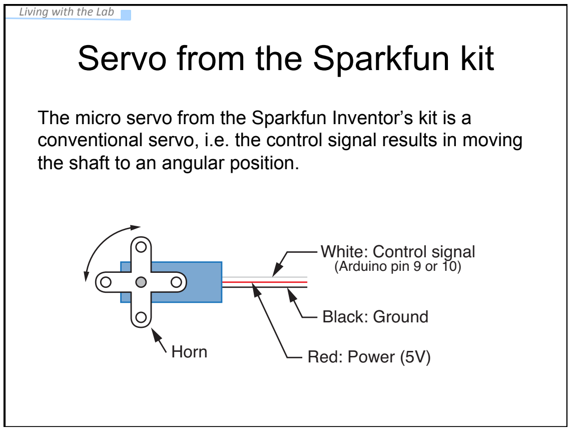
Servo components

1. Small DC motor
2. Gearbox with small plastic gears to reduce the RPM and increase output torque
3. Special electronics to interpret a pulse signal and deliver power to the motor

DC Motor
Gears to Reduce RPM and Increase Torque of DC Motor
Electronics to Control the DC Motor
PARALLAX



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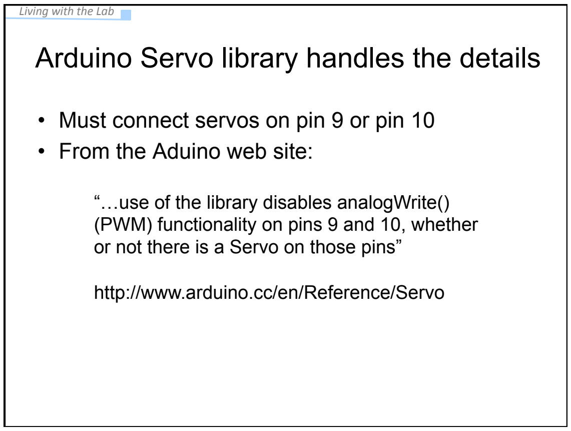
Servo from the Sparkfun kit

The micro servo from the Sparkfun Inventor's kit is a conventional servo, i.e. the control signal results in moving the shaft to an angular position.



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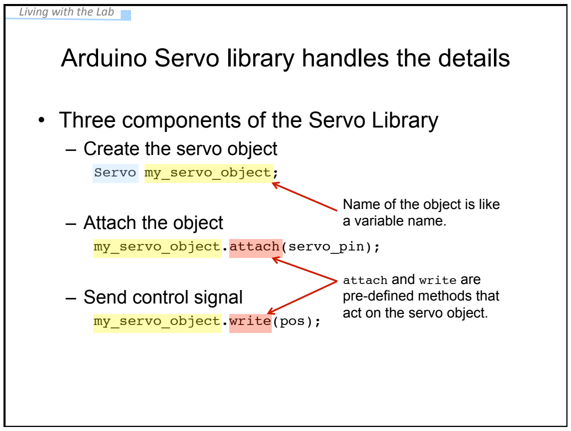
Arduino Servo library handles the details

- Must connect servos on pin 9 or pin 10
- From the Aduino web site:

> "…use of the library disables analogWrite() (PWM) functionality on pins 9 and 10, whether or not there is a Servo on those pins"
>
> http://www.arduino.cc/en/Reference/Servo



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Arduino Servo library handles the details

- Three components of the Servo Library
  - Create the servo object

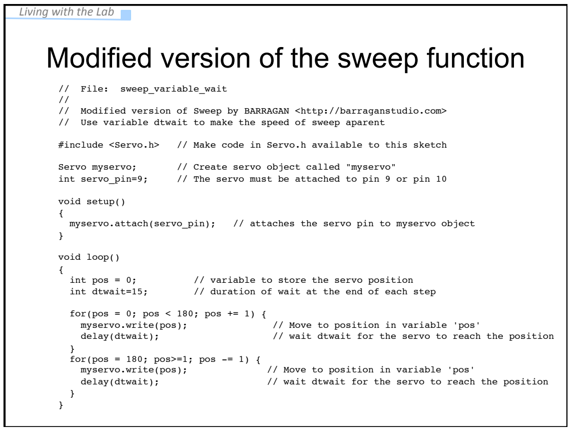
    `Servo my_servo_object;`
  - Attach the object

    `my_servo_object.attach(servo_pin);`
  - Send control signal

    `my_servo_object.write(pos);`

Name of the object is like a variable name.

`attach` and `write` are pre-defined methods that act on the servo object.



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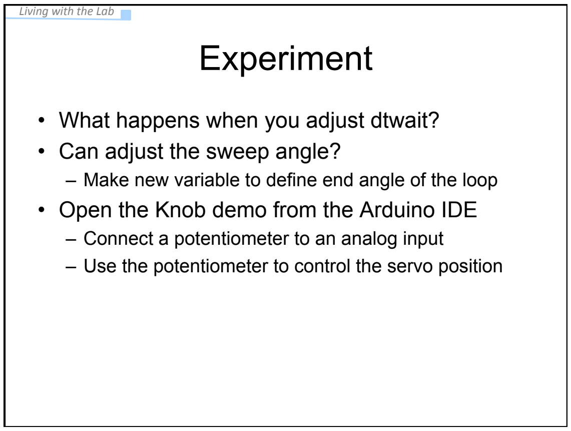
Modified version of the sweep function

```
//  File:  sweep_variable_wait
//
//  Modified version of Sweep by BARRAGAN <http://barraganstudio.com>
//  Use variable dtwait to make the speed of sweep aparent

#include <Servo.h>   // Make code in Servo.h available to this sketch

Servo myservo;       // Create servo object called "myservo"
int servo_pin=9;     // The servo must be attached to pin 9 or pin 10

void setup()
{
  myservo.attach(servo_pin);   // attaches the servo pin to myservo object
}

void loop()
{
  int pos = 0;          // variable to store the servo position
  int dtwait=15;        // duration of wait at the end of each step

  for(pos = 0; pos < 180; pos += 1) {
    myservo.write(pos);               // Move to position in variable 'pos'
    delay(dtwait);                    // wait dtwait for the servo to reach the position
  }
  for(pos = 180; pos>=1; pos -= 1) {
    myservo.write(pos);              // Move to position in variable 'pos'
    delay(dtwait);                   // wait dtwait for the servo to reach the position
  }
}
```



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Experiment

- What happens when you adjust dtwait?
- Can adjust the sweep angle?
  - Make new variable to define end angle of the loop
- Open the Knob demo from the Arduino IDE
  - Connect a potentiometer to an analog input
  - Use the potentiometer to control the servo position