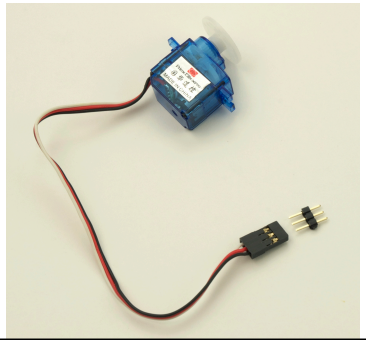
Living with the Lab

Using servos with an Arduino



Living with the Lab

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

Living with the Lab

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

Living with the Lab

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.

Living with the Lab

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.

Living with the Lab

Conventional and Continuous Rotation

Two types of servos

continuous rotation
can rotate all the way around in either direction

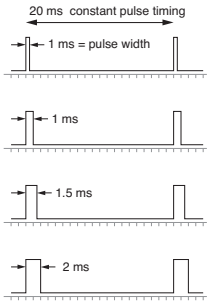
pulse tells servo
which way to spin & how fast to spin

standard
can only rotate 180 degrees

pulse tells servo
which position to hold

Living with the Lab

Control signal is a pulse train



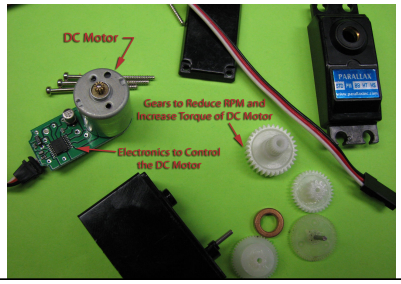
Pulse frequency is fixed
Typical: 20 ms

Pulse width determines position
Typical: 1ms to 2 ms

Living with the Lab

Servo components

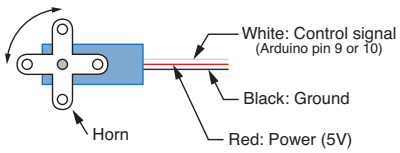
1. Small DC motor
2. Gearbox with small plastic gears to reduce the RPM and increase output torque
3. Special electronics to interpret a pulse signal and deliver power to the motor



Living with the Lab

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.



Living with the Lab

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

Living with the Lab

Arduino Servo library handles the details

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

```
Servo my_servo_object;
```

Name of the object is like a variable name.

  - Attach the object

```
my_servo_object.attach(servo_pi);
```

  - Send control signal

```
my_servo_object.write(pos);
```

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

Living with the Lab

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
  }
}
```

Living with the Lab

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