Renbotics Servo Shield

Applications
- Robotics
- Animatronics
- Mechatronic Art

Features
- 16 Servo Channels
- Convenient screw terminal for servo power supply
- 196 Point breadboard style prototyping area
- Compatible with Arduino Duemilanove and Arduino Mega
- Easy to use API
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1. License

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3. Description

The Renbotics Servo Shield is an Arduino-compatible shield that uses two 4017 decade counters to drive up to 16 servos using only 4 pins (digital pins 6 to 9) and as little as one 8bit timer (Timer 2) in standard mode or two 16/8bit timers (Timer 1 and Timer 2 for Duemilanove or Timer 3 for Mega) in high accuracy mode. It also includes a 196 point breadboard style prototyping area.

4. Overview

Image 1: Renbotics Servo Shield Overview
5. Features

- 16 Servo Channels
- Convenient screw terminal for servo power supply
- 196 Point breadboard style prototyping area
- Compatible with Arduino Duemilanove and Arduino Mega
- Easy to use API

6. Applications

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7. Parts List

Image 2: Renbotics Servo Shield Parts

1 x Renbotics Servo Shield Bare
2 x 4017 Decade Counter DIP16
2 x 10nf Capacitors
2 x 6 pin Female Shield Stacking Headers
2 x 8 pin Female Shield Stacking Headers
1 x 2 pin Screw Terminal
3 x 16 pin Male Breakaway Headers
8. Assembly

Follow these 5 simple steps to assemble your Renbotics Servo Shield:

1. Solder the two supplied 10nF capacitors.

![Image 3: Assembly Step 1](Image 3: Assembly Step 1)

2. Solder the two supplied 4017 IC’s.

![Image 4: Assembly Step 2](Image 4: Assembly Step 2)
3. Solder the supplied servo headers.

Image 5: Assembly Step 3

4. Solder the supplied stacking headers.

Image 6: Assembly Step 4
5. Solder the supplied screw terminal.

Image 7: Assembly Step 5

Your Renbotics Servo Shield is now ready to be used.
9. RC Servo Control Basics

A RC Servo is controlled by sending it a pulses ranging from 1ms to 2ms in duration, Pulse-width modulation (PWM), at 50Hz (50 pulses per second). On a typical servo a 1.5ms pulse will center a servo at 90deg, a 1ms pulse will move the servo to 0deg and a 2ms pulse will move the servo to 180deg (See Image 8).

![Image 8: Servo Control Overview](Image 8: Servo Control Overview)

A typical RC Servo has three wires, one for the control signal and the other two for power (See Image 9).

The most common wire colors are:
- Signal: White or Orange
- Negative: Black
- Positive: Red or Brown

On the Servo Shield the Negative (Black) wire always faces to the outside of the board.

[Picture of connection here]

The Servo Shield has two modes of operation; Standard and High Accuracy. In Standard mode the Servo Shield can move all 16 servos in 25us increments allowing for a resolution of 4.5deg per increment. Standard is supported on the Duemilanove (ATMega232 based) and Mega (ATMega128 based).

In High Accuracy mode the Servo Shield can move servos 1-9 on the Duemilanove and 1 – 16 on the Mega in 1us increments allowing for a resolution of 0.18deg per increment. On the Duemilanove servos 10 – 16 can only be operated in Standard mode.
10. Library

The Servo Shield Library is based on work done by Larry Barelo in R/C pulse output unit based upon a 74HC4017 decade counter [1].

**Installing the Library**

**Note:** If you currently have an older version of the Servo Shield library you need to first delete the ServoShield folder from your arduino-[version]/hardware/libraries folder. If you don’t perform this step, the newer version of the libraries might not get compiled.

The ServoShield object uses Timer1, Timer 2 and/or Timer3 for timing the servo pulses, thus the ServoShield might conflict with other libraries that use or rely on Timer1, Timer 2 and/or Timer3.

Download servoshield.zip from [http://www.renbotics.com/files/servoshield.zip](http://www.renbotics.com/files/servoshield.zip) and extract it to your arduino-[version]/hardware/libraries folder.

**Functions**

```c
int setPosition(int servo, int position);
```

Sets the position of the specified servo. Returns 0 if successfully set; returns 1 if instruction failed.

```c
int setBounds(int servo, int minPosition, int maxPosition);
```

Sets the valid maximum and minimum bounds of the specified servo; returns 1 if instruction failed.

Defaults are 1000 and 2000

```c
int getPosition(int servo);
```

Returns the current position of the specified servo.

```c
int start();
```

Starts the servo controller; returns 1 if instruction failed.

```c
int stop();
```

Stops the servo controller; returns 1 if instruction failed.
Enabling High Accuracy Mode

To enable High Accuracy Mode simply edit the following file:

```
arduino-00XX\hardware\libraries\ServoShield\ServoShield.h
```

and change

```
//define HIGHACCURACY
```

to

```
#define HIGHACCURACY
```
Appendix A Sample Sketches

Sample 1: Simple servo sweeper

```
#include <ServoShield.h>

ServoShield servos; //Create a ServoShield object

void setup()
{
    for (int servo = 0; servo < 16; servo++) //Initialize all 16 servos
    {
        servos.setbounds(servo, 1000, 2000); //Set the minimum and maximum pulse duration
        servos.setposition(servo, 1500); //Set the initial position of the servo
    }

    servos.start(); //Start the servo shield
}

void loop()
{
    for(int pos = 1000; pos < 2000; pos++) //Move the servos from 0 degrees to 180 degrees
    {
        for (int i = 0; i < 16; i++) //for all 16 servos
        {
            servos.setposition(i, pos); //Tell servo to go to position in variable 'pos'
            delay(1);
        }
    }

    for(int pos = 2000; pos >= 1000; pos--) //Move the servos from 180 degrees to 0 degrees
    {
        for (int i = 0; i < 16; i++) //all 16 servos
        {
            servos.setposition(i, pos); //Tell servo to go to position in variable 'pos'
            delay(1);
        }
    }
}
```
Appendix B Schematic
Appendix C References