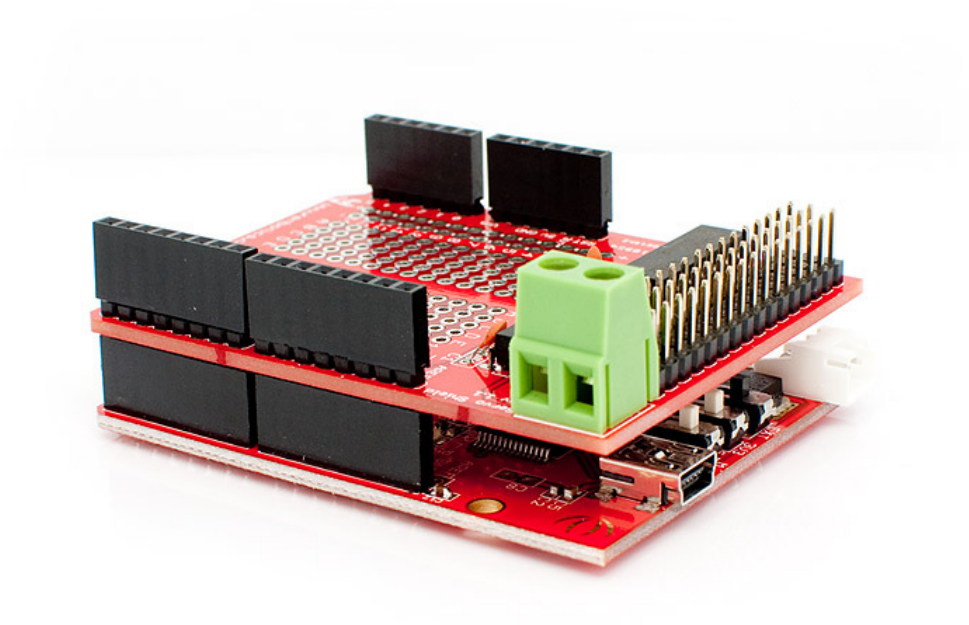
Renbotics

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

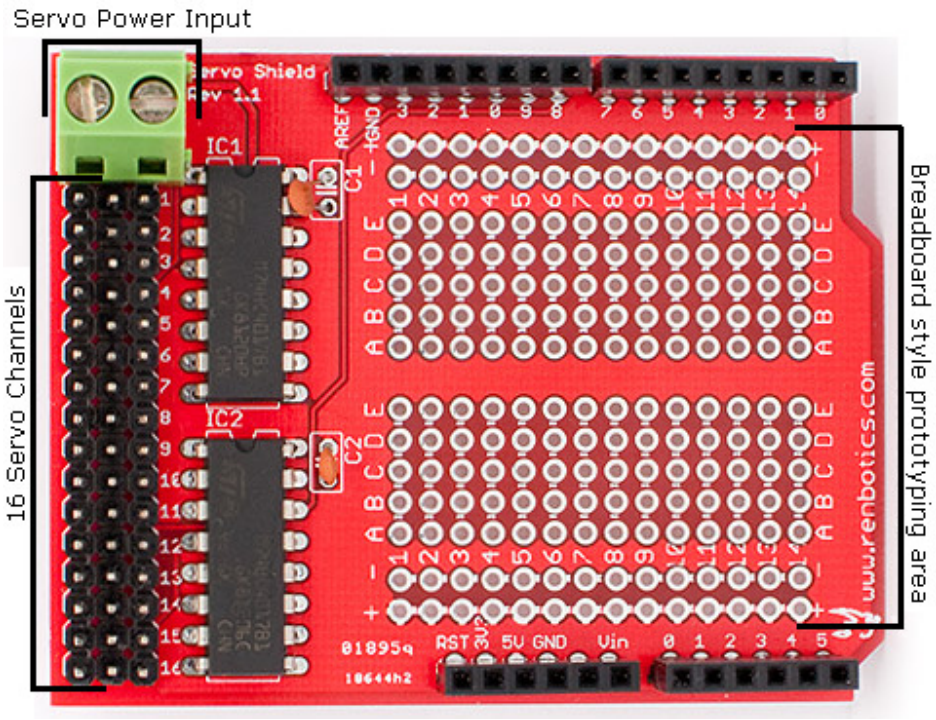


Image 1: Renbotics Servo Shield Overview

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

- Robotics
- Animatronics
- Mechatronic Art

7. Parts List

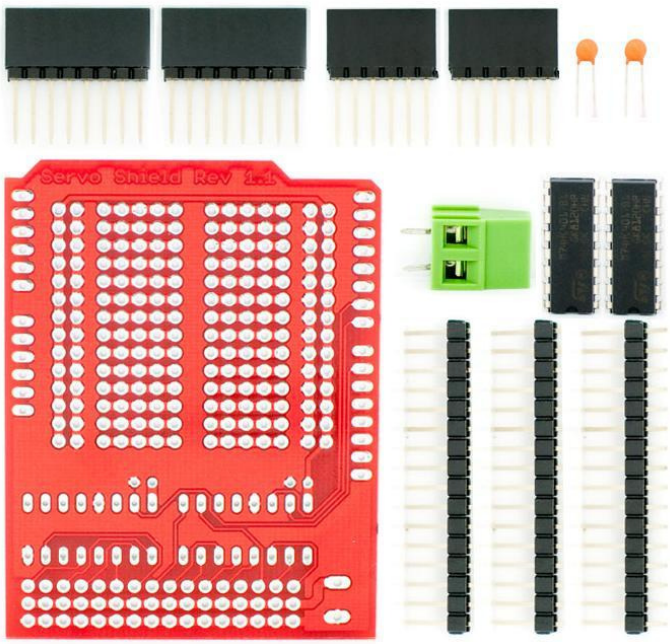


Image 2:Renbotics Servo Shield Parts

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.

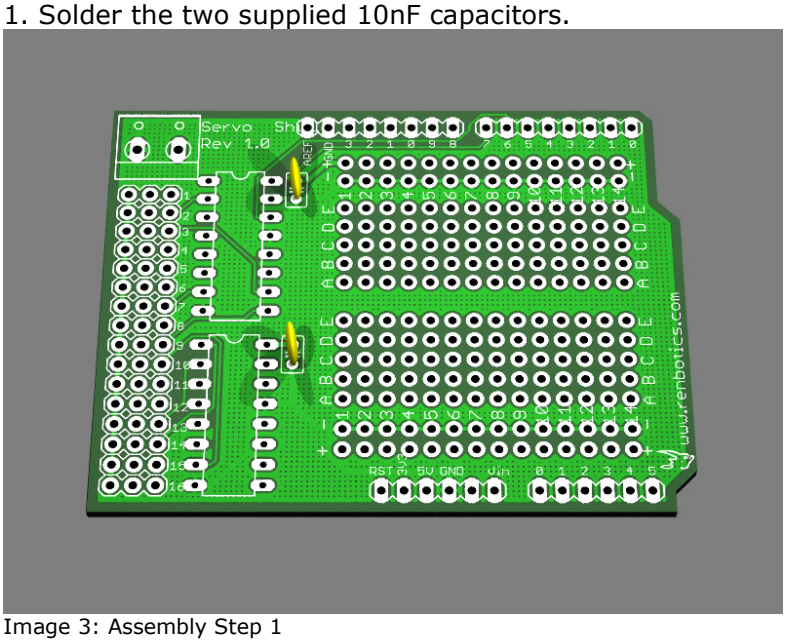


Image 3: Assembly Step 1

2. Solder the two supplied 4017 IC's.

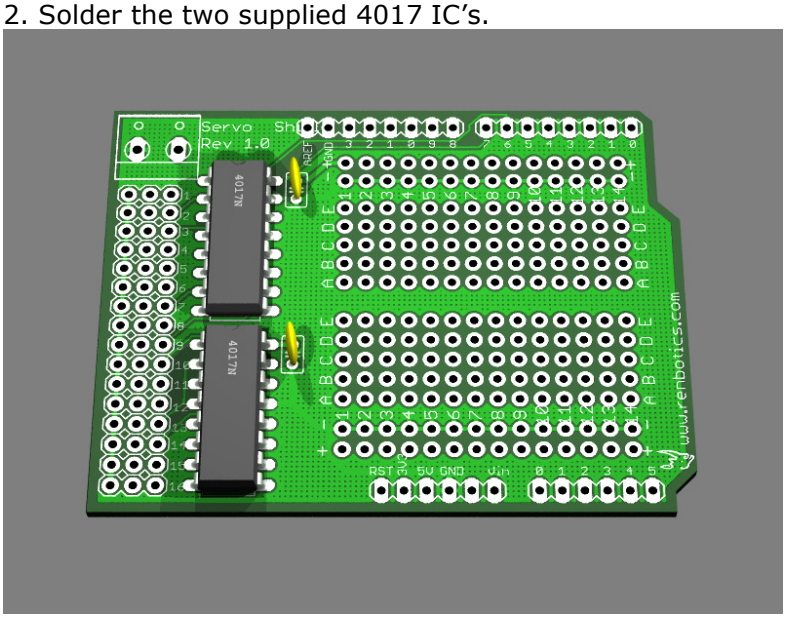


Image 4: Assembly Step 2

3. Solder the supplied servo headers.

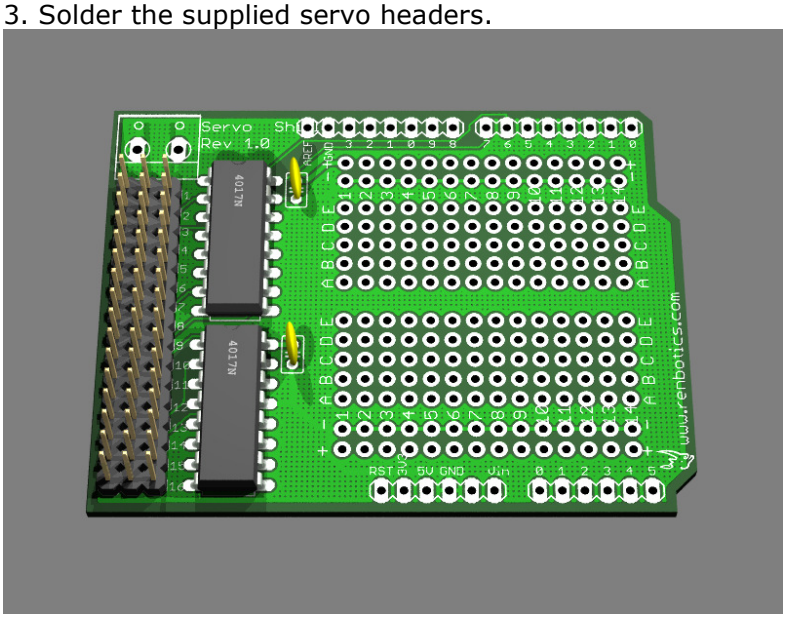


Image 5: Assembly Step 3

4. Solder the supplied stacking headers.

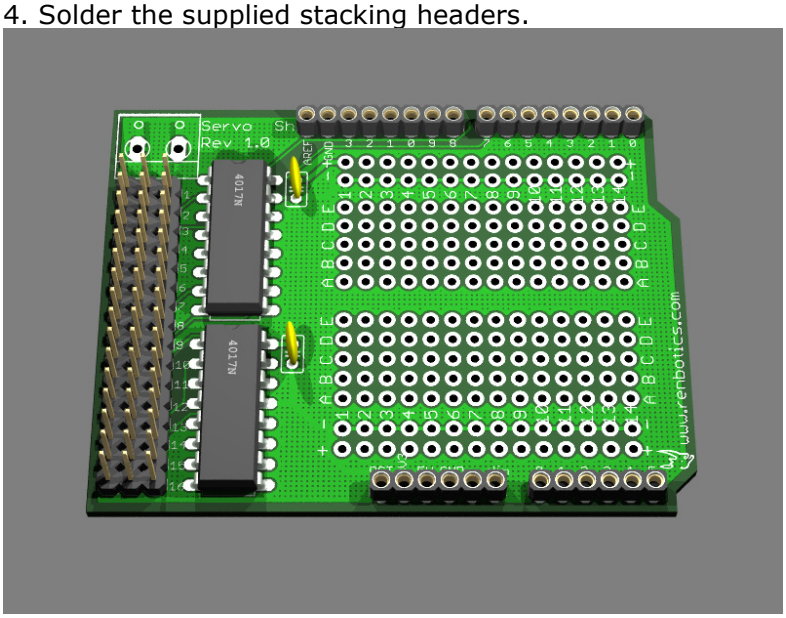


Image 6: Assembly Step 4

5. Solder the supplied screw terminal.

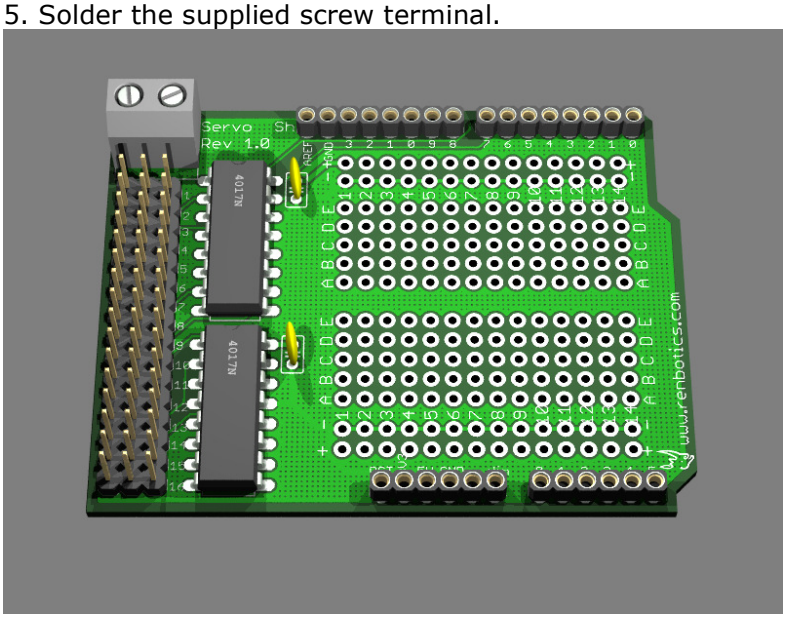


Image 7: Assembly Step 5

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).

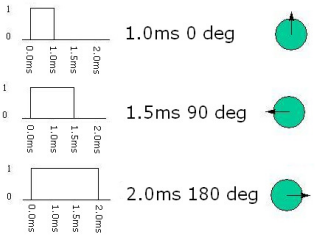


Image 8: Servo Control Overview

Image 9: Servo Cable

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 Barello 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**.

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

Functions

```
int setposition(int servo, int position);
```

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

```
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

```
int getposition(int Servo);
```

Returns the current position of the specified servo.

```
int start();
```

Starts the servo controller; returns 1 if instruction failed.

```
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

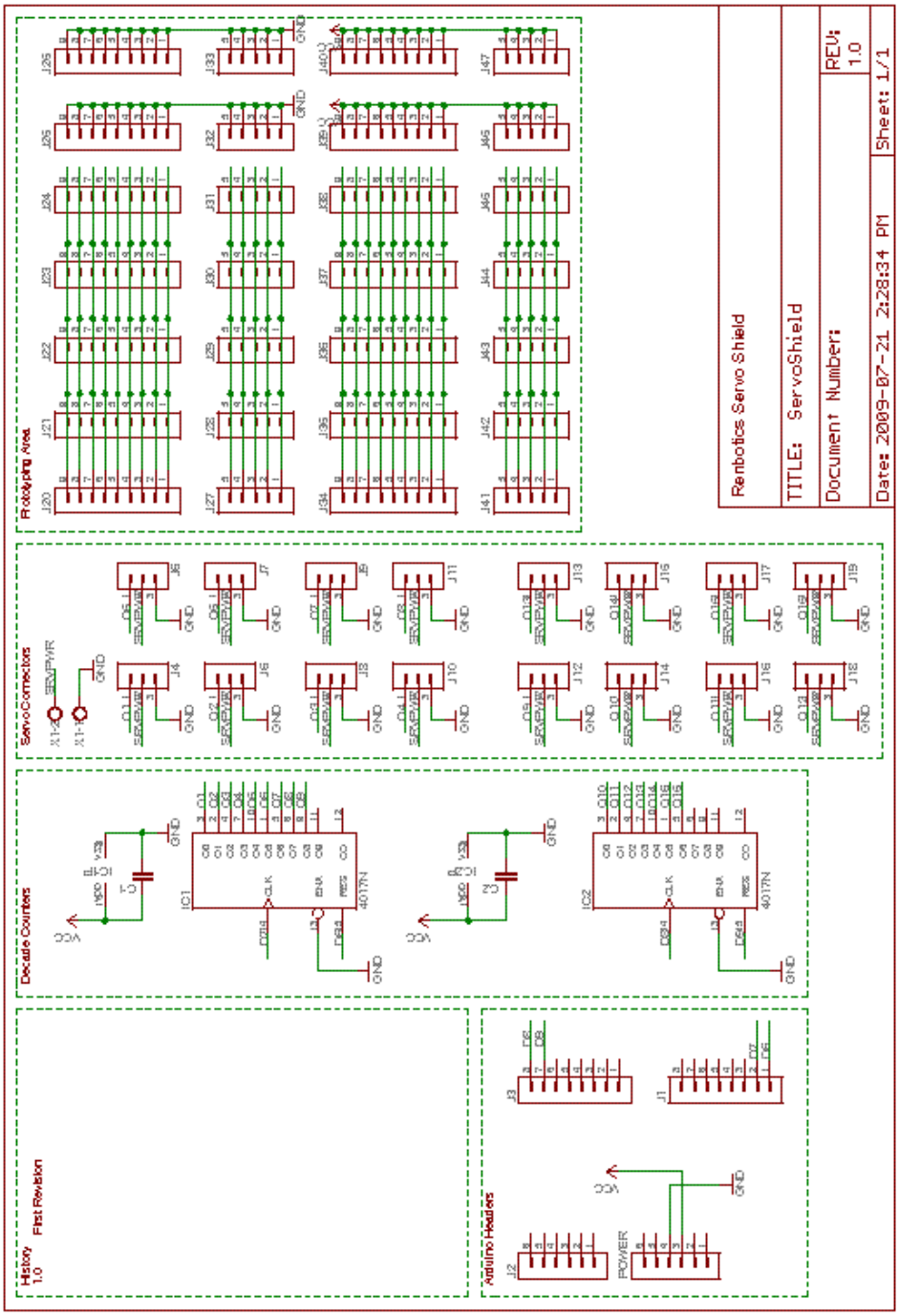
```
#define HIGHACCURACY
```

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
  {                                      //in steps of 1 degree
    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

[1] Larry Barello, *R/C pulse output unit based upon a 74HC4017 decade counter*,
http://www.barello.net/Papers/AVR%20RC%20output.pdf