# Preface

## About SunFounder

SunFounder is a company focused on STEAM education with products like open source robots, development boards, STEAM kit, modules, tools and other smart devices distributed globally. In SunFounder, we strive to help elementary and middle school students as well as hobbyists, through STEAM education, strengthen their hands-on practices and problem-solving abilities. In this way, we hope to disseminate knowledge and provide skill training in a full-of-joy way, thus fostering your interest in programming and making, and exposing you to a fascinating world of science and engineering. To embrace the future of artificial intelligence, it is urgent and meaningful to learn abundant STEAM knowledge.
Visit www.sunfounder.com for more!

## About This Kit

The Rollarm Kit for Arduino is designed for mass hobbyists to learn robot arm control. With the open source MCU Arduino UNO and a servo expansion board, the robot arm is easy to use and full of fun. You can control its four axes by the 4 potentiometers on the handle, as well as make them move on your computer. In addition, it can memorize the movements it's made and repeat again and again, making it a great tool for repeated tasks.

In this book, you can learn the basics of how a mechanical arm works and how to make one piece by piece. For more information, please go to our website www.sunfounder.com and find the tutorial under LEARN -> Get tutorials. Also video tutorials about the assembly and playing are provided under VIDEO -> Robot Kit -> Rollarm.

## Free Support

u have any **TECHNICAL question**, add a topic under FORUM section on our website and we'll reply as soon as possible.

**NON-TECH questions** like order and shipment issues, please send an email to service@sunfounder.com. You're also welcomed to share your projects on FORUM.

# Contents

1. Introduction....1
1.1 Overview....1
2. Components List....2
2.1 Acrylic Plates....2
2.2 Connecting Components....3
2.3 Electronic Components....5
2.4 Tools....7
2.5 Self-Provided Components....7
3. How to Control....8
4. Getting Started with Software....9
4.1 Description....9
4.2 Install Arduino IDE....9
4.3 Install CH341Ser driver....13
5. Assembly....15
5.1 Base Bottom Plate + Riband....15
5.2 Base Bottom Plate + Battery Holder....15
5.3 Base Bottom Plate + Circuit Board....16
5.4 Base Bottom Plate + Base Fixing Plate....17
5.5 Base Upper Plate + Servo 1....18
5.6 Base Fixing Plate + Base Upper Plate....19
5.8 Adjust the Servo 1....20
5.9 Joint 1-Connecting Plate + Servo Rocker Arm....22
5.10 Right Joint Plate 1....22
5.11 Joint 1 Connecting Plate....23
5.12 Base + Joint 1 Connecting Plate....23
5.13 Joint 2 + Right Joint Plate 2....24
5.14 Adjust The Servo 2 and The Servo 3....26
5.15 Joint 1 Connecting Plate + Joint 2 Connecting Plate....26
5.16 Joint 1 Connecting Plate....27

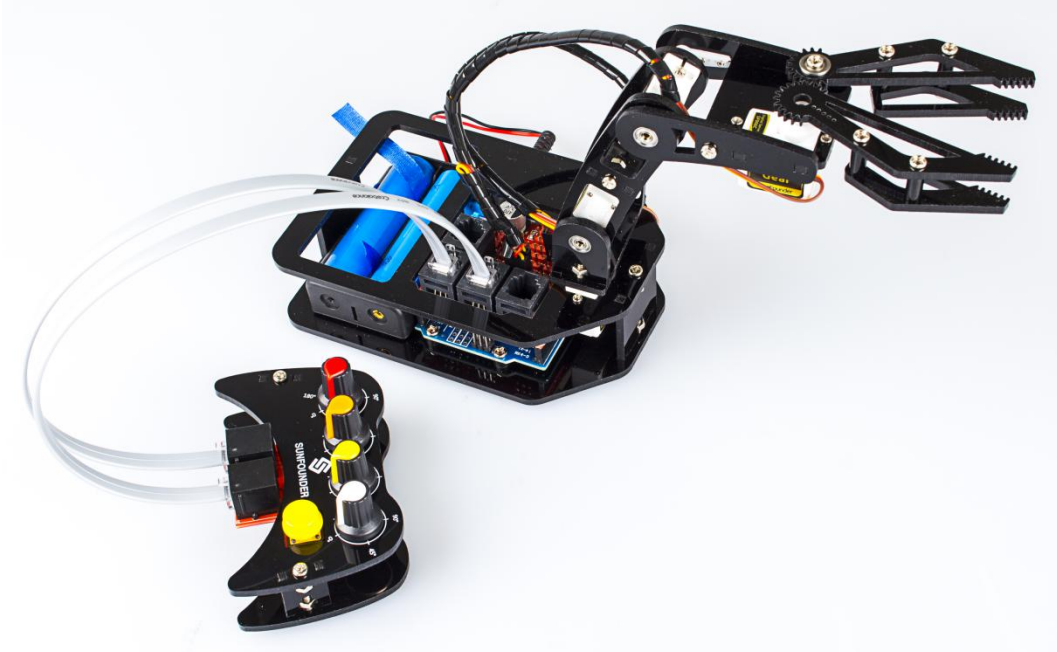
5.17 Gripper Fixing Plate....28
5.18 Adjust The Servo 4....29
5.19 Gripper Driving Plate + Gripper Driven Plate....29
5.20 Grippers + Gripper Fixing Plate....31
5.21 Right Joint Plate 3....32
5.22 Gripper Fixing Plate + Right Joint Plate 3....33
5.23 Joint 2 Connecting Plate + Joint 3 Connecting Plate....33
5.24 Left Joint Plate 3....34
5.25 Handle....35
5.26 Wiring....37
6. Control the Rollarm....38
6.1 Manual Control....38
6.1.1 Recording behavior....39
6.1.2 Code Explanation....40
6.2 PC Control (by Labview)....43
6.2.1 Installing Labview Software....43
6.2.2 Upload the Code....44
6.2.3 Using the Software....46

# 1. Introduction

## 1.1 Overview

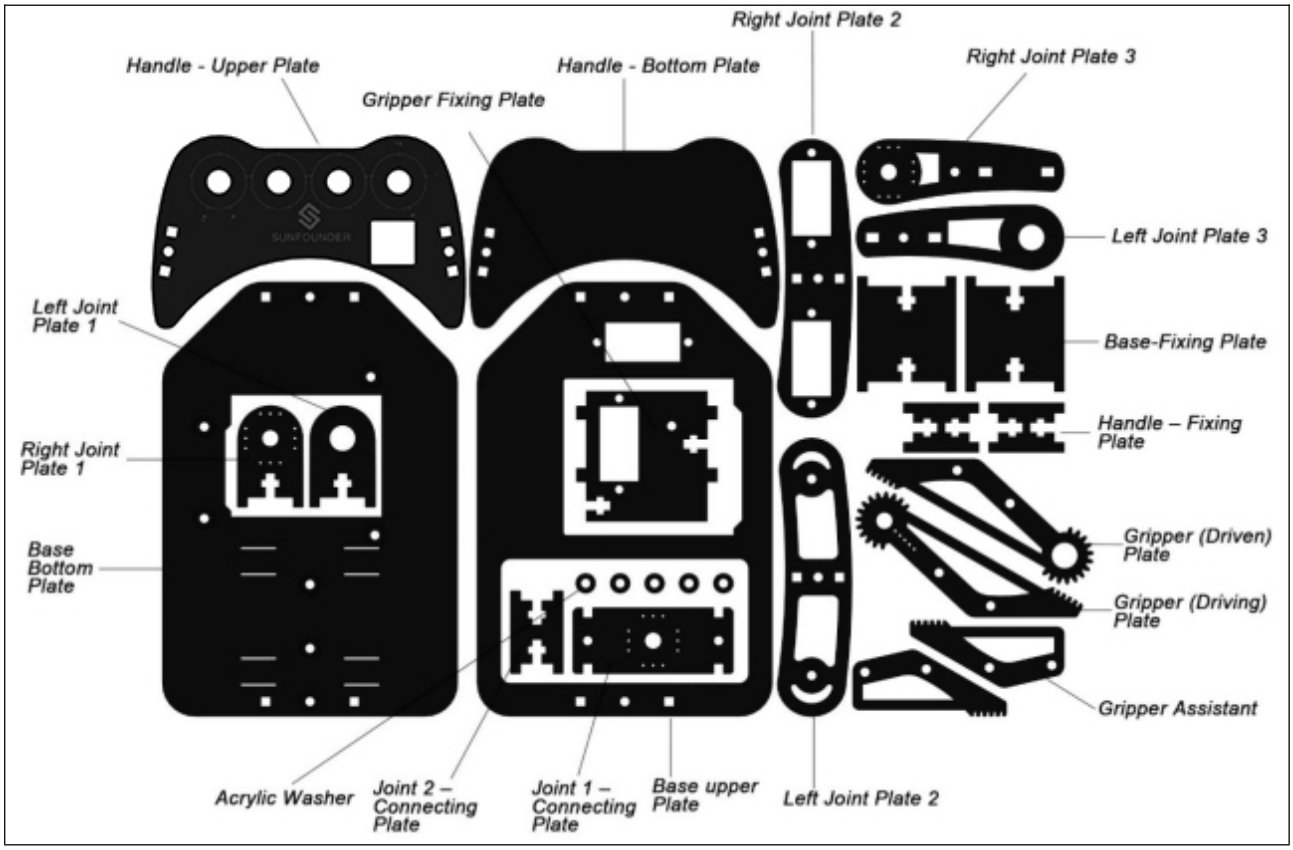
The Rollarm Kit is an interesting and useful learning tool for Arduino and robot hobbyists. With the acrylic design and code based on Arduino, it enables users to learn programming from easy to difficult, control the mechanical arm freely and perform various fun operations!

This fun mechanical arm consists of 4 axes, each controlled by a servo. Powered by two 18650 batteries, the control systems is composed of UNO board, servo extension board, and remote control board. The kit includes all necessary components like acrylic plates, circuit boards, and connector parts. For your better learning, installation and debugging video tutorials are provided on our website. Also you can download the user manual which elaborates on the installation procedures and program explanation. With these resources, you can quickly and effortlessly make creative projects with the Rollarm. Now let's go to get the fun!

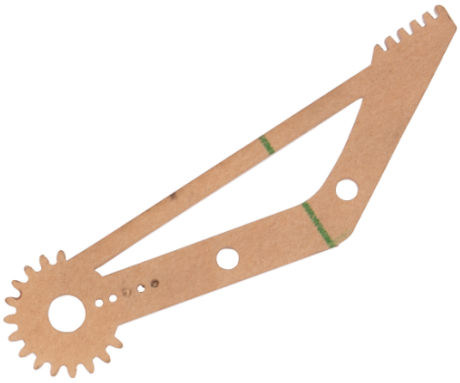


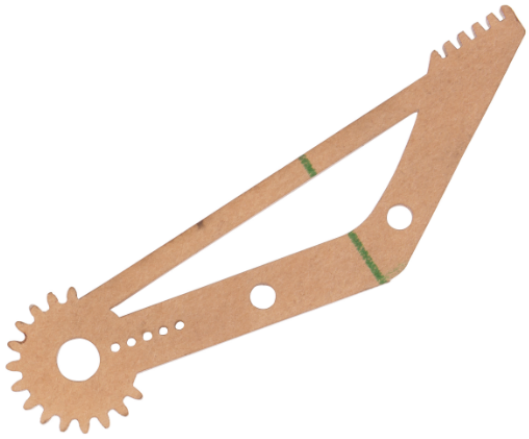
# 2. Components List

## 2.1 Acrylic Plates

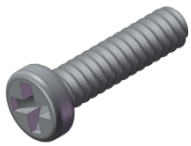
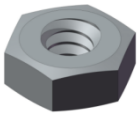
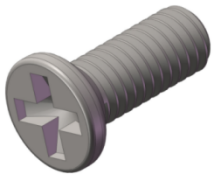
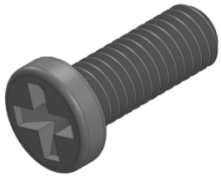


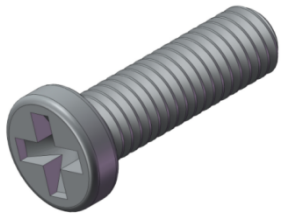
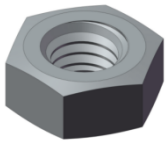
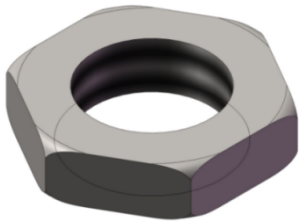
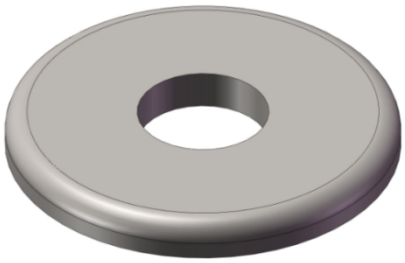
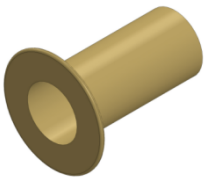
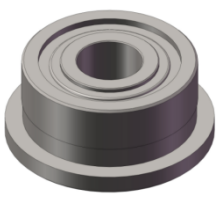

Prior to assembling the Rollarm, you need to remove the residues in the holes of the plates and the stickers on the plates. Here we take the Joint 1 fixing plate for example.

| 1. Check whether there are some residues in the holes of the acrylic plate. | 2. Use a tool with a pointed end to remove the residue. |
|---|---|
|  |  |

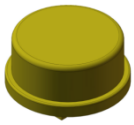
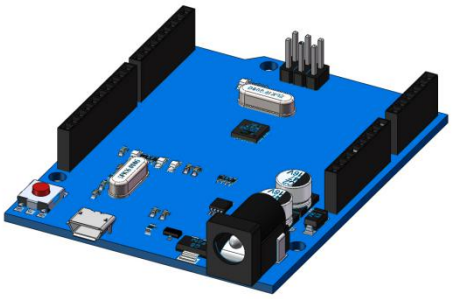
| | |
|---|---|
| 3. Make sure that all the residues are cleared.<br>  | 4. Use the pointed tool to scratch off the sticker on the plate.<br>  |

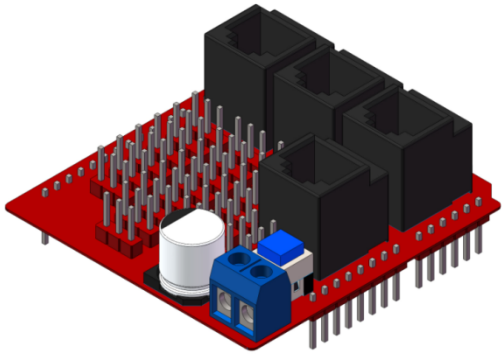
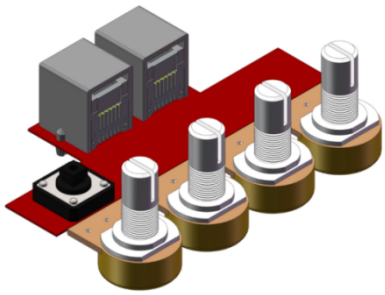
## 2.2 Connecting Components

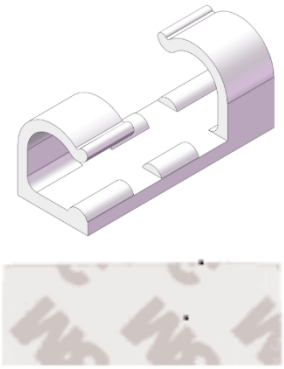
| Name | Component | Qty. |
|---|---|---|
| M1.2*4<br>Self-tapping Screw |  | 16 |
| M2*8 Screw |  | 10 |
| M2 Nut |  | 10 |
| M3*8 Flat-Head Screw |  | 4 |
| M3*8 Screw |  | 12 |

| | | |
|---|---|---|
| M3*10 Screw |  | 20 |
| M3 Nut |  | 22 |
| M7 Thin Nut |  | 5 |
| 3*10*1 Washer |  | 2 |
| M3*10 Aluminum Tube |  | 7 |
| M3*6 Corn Rivet |  | 3 |
| Φ3* Φ8*4 Band Edge Bearing |  | 3 |

## 2.3 Electronic Components

| Name | Component | Qty. |
|---|---|---|
| SunFounder Servo |  | 4 |
| Potentiometer Button |  | 4 |
| Button |  | 1 |
| 18650*2 Battery Holder |  | 1 |
| UNO Board |  | 1 |

| | | |
|---|---|---|
| Expansion Board |  | 1 |
| Potentiometer Module |  | 1 |
| USB Cable |  | 1 |
| RJ11 Cable |  | 2 |
| Riband |  | 1 |
| 3M Non-skid Pad |  | 4 |
| Heat Shrink Tubing |  | 2 |

| | | |
|---|---|---|
| Cable Clip |  | 2 |

## 2.4 Tools

| | | |
|---|---|---|
| Screw Driver |  | 1 |

## 2.5 Self-Provided Components

| | | |
|---|---|---|
| 18650 Battery |  | 2 |

# 3. How to Control

1) Install Arduino IDE

2) Assemble the Rollarm (Remember to configure the servos before assembly. Pay attention to the detailed operations)

3) Control with handle: download the Rollarm package and run the program (Indispensable step before operating the Rollarm)

4) Control with Labview: download the Labview to your PC and install for control (download is a must-do before subsequent operating)

Let's get started. Enjoy!

# 4. Getting Started with Software

## 4.1 Description

Arduino is an open source platform that applies simple software and hardware. You can get it in a short even when you know little of it. It provides an integrated development environment (IDE) for code editing and compiling, compatible with multiple control boards. So you can just download the Arduino IDE, upload the sketches (i.e. the code files) to the board, and then you can see experimental phenomena. For more information, refer to http://www.arduino.cc.

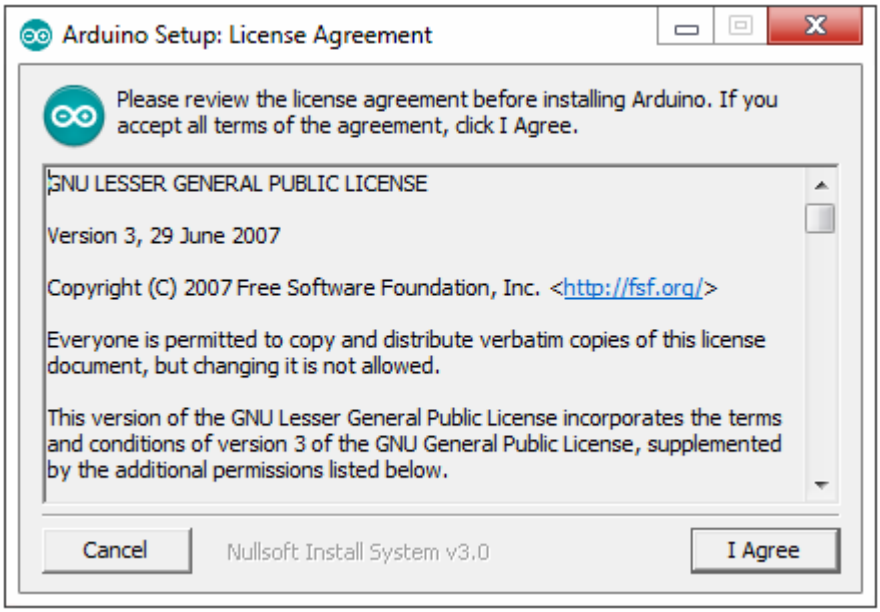
## 4.2 Install Arduino IDE

The code in this kit is written based on Arduino, so you need to install the IDE first. Skip it if you have done this.

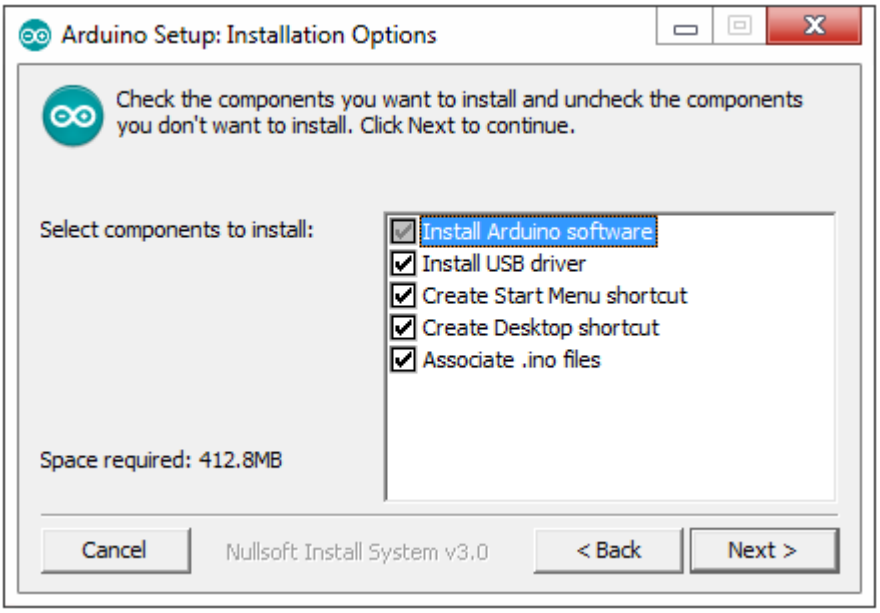
**Step 1**: Go to the arduino.cc website and click **Download**. On the page, check the software list on the right side under Download the Arduino Software.


Find the one that suits your operation system and click to download. There are two versions of Arduino for Windows: Installer or ZIP file. You're recommended to download the former.

**Step 2**: Double click the .exe file and the following window will show up. Click **I Agree**. The following interface will show up.

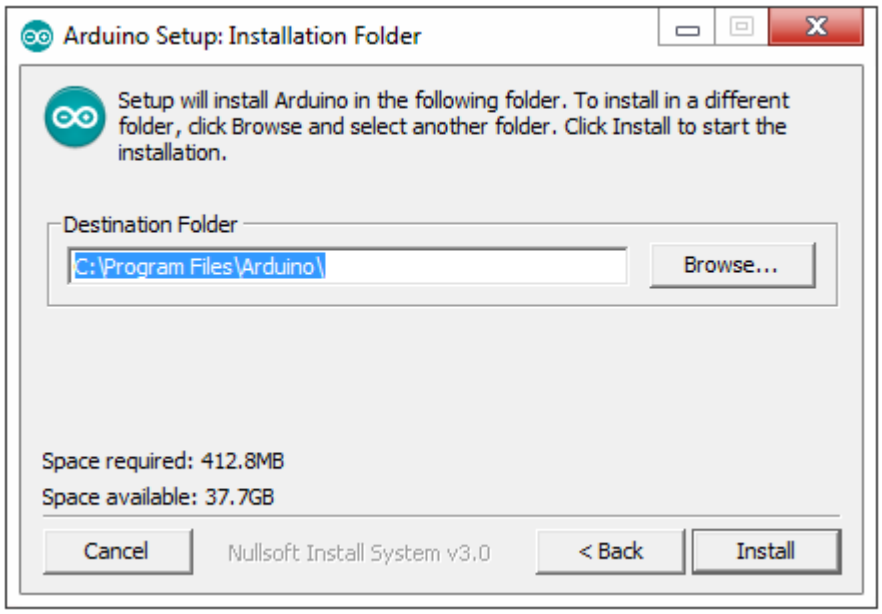

Arduino Setup: License Agreement
Please review the license agreement before installing Arduino. If you accept all terms of the agreement, click I Agree.
GNU LESSER GENERAL PUBLIC LICENSE
Version 3, 29 June 2007
Copyright (C) 2007 Free Software Foundation, Inc. <http://fsf.org/>
Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.
This version of the GNU Lesser General Public License incorporates the terms and conditions of version 3 of the GNU General Public License, supplemented by the additional permissions listed below.
Cancel
Nullsoft Install System v3.0
I Agree

Choose **Next**.

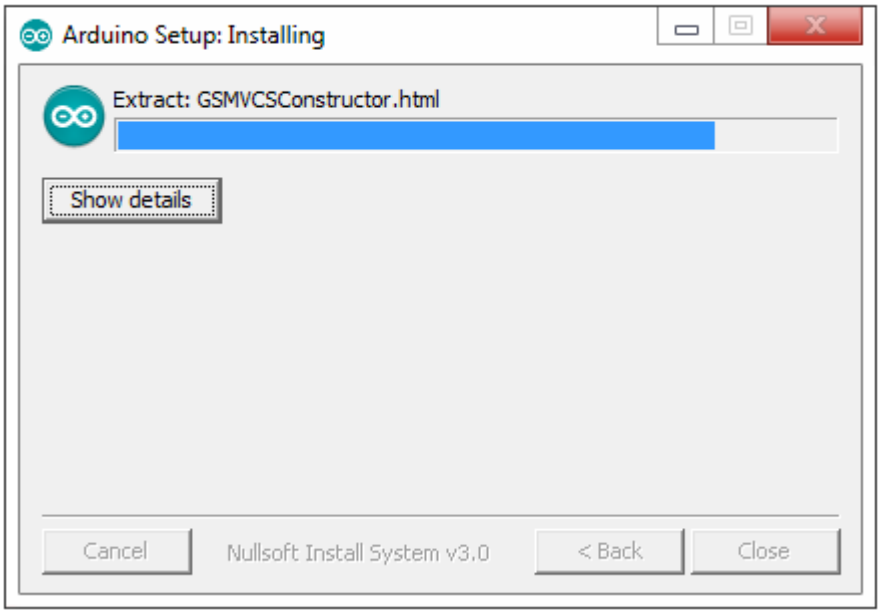

Arduino Setup: Installation Options
Check the components you want to install and uncheck the components you don't want to install. Click Next to continue.
Select components to install:
Install Arduino software
Install USB driver
Create Start Menu shortcut
Create Desktop shortcut
Associate .ino files
Space required: 412.8MB
Cancel
Nullsoft Install System v3.0
< Back
Next >

Click **Browse** to choose the installation path or enter a directory at the **Destination Folder**.

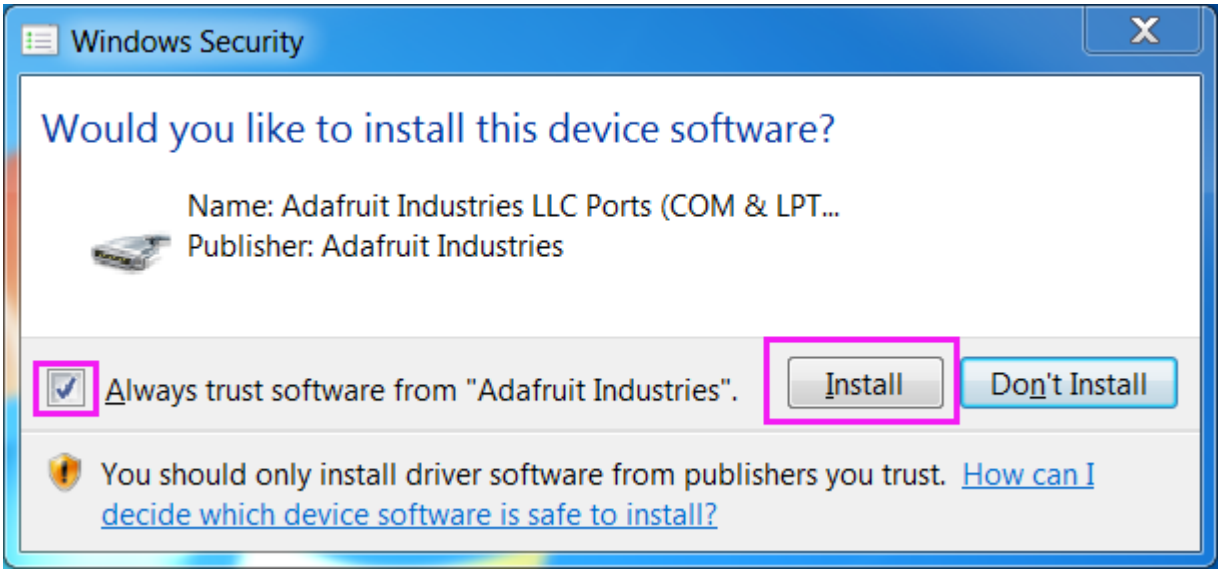
Click **Install.**



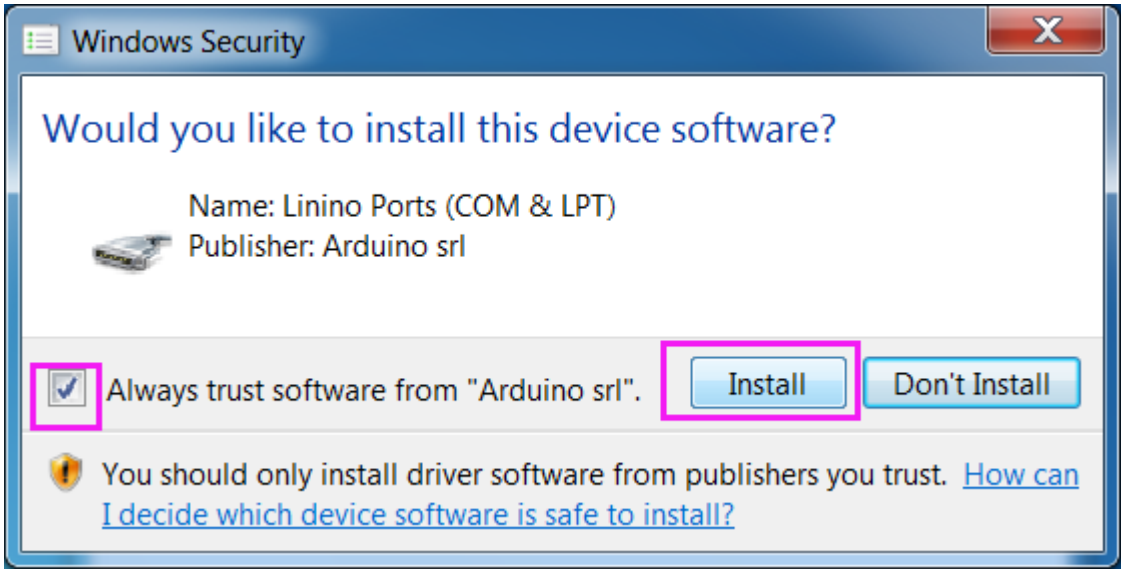

The following interface will show up. Note: After the installing progress bar goes to the end, the Close button may be enabled for some PC. Just click it to complete the installation.



Then a prompt appears. Select Always trust software for "Adafruit Industries" and click **Install**.



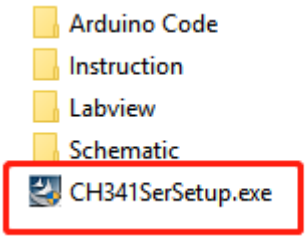

Select Always trust software for "Arduino srl" and click **Install**.



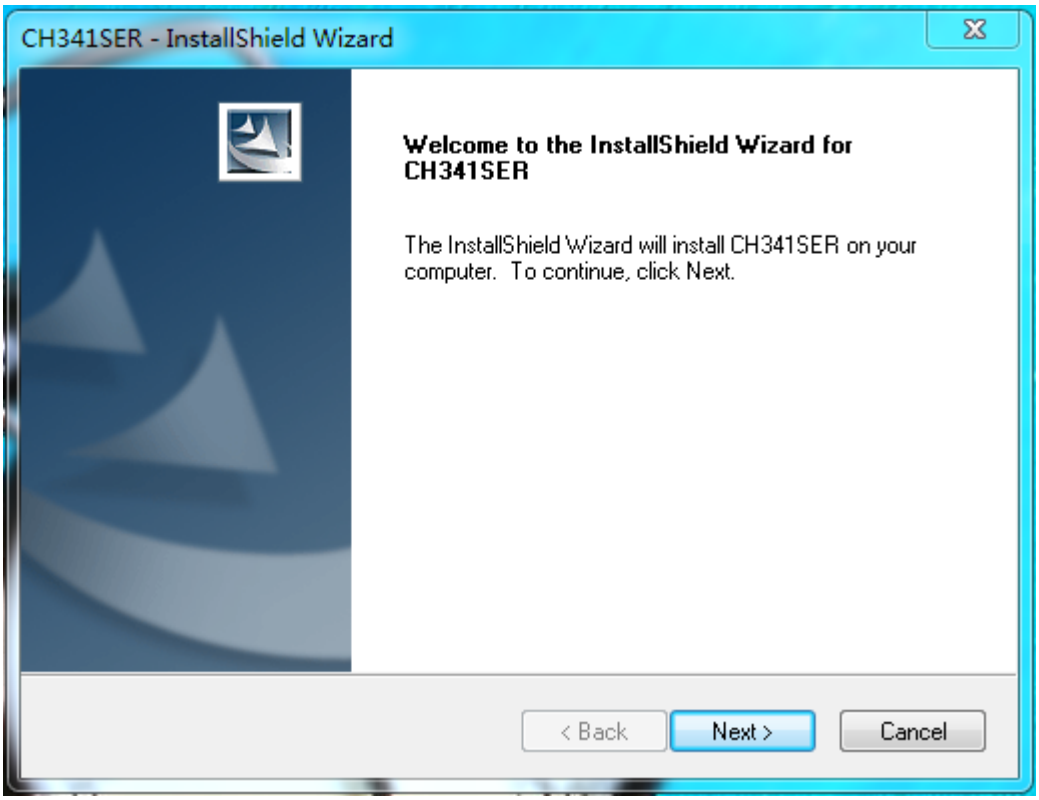

After the installation is done, click **Close**. Then an Arduino icon will appear on the desktop:

## 4.3 Install CH341Ser driver

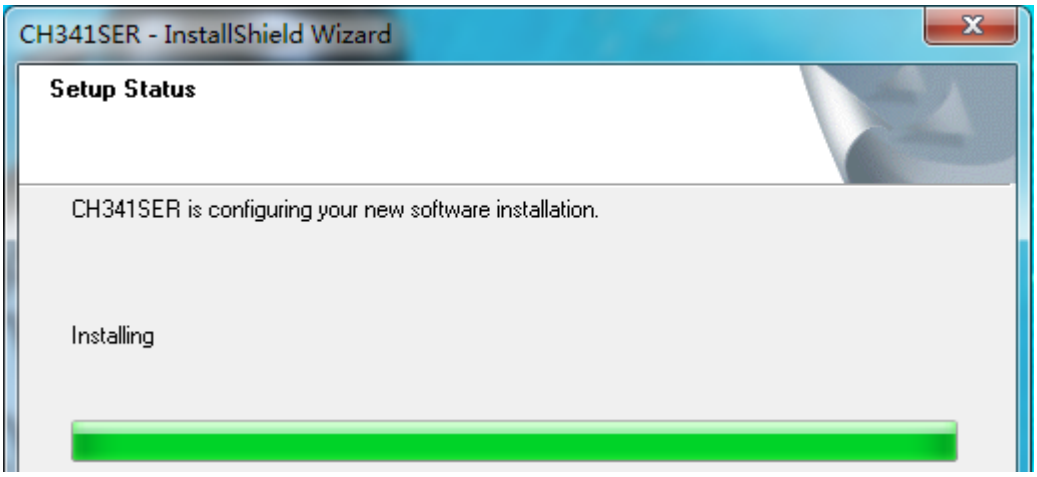
Unzip the downloaded DIY_Control_Robot_Arm_kit_for_Arduino-Rollarm file and double click to run CH341SerSetup.exe.



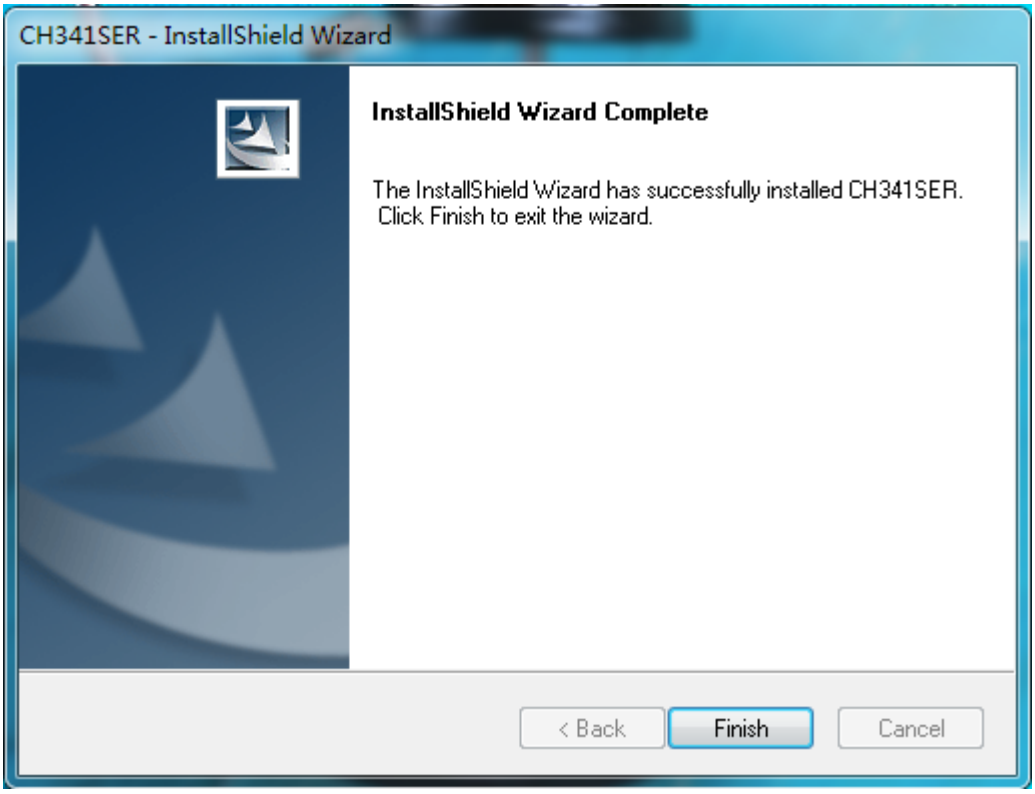

Choose **Next**.




Wait a moment.



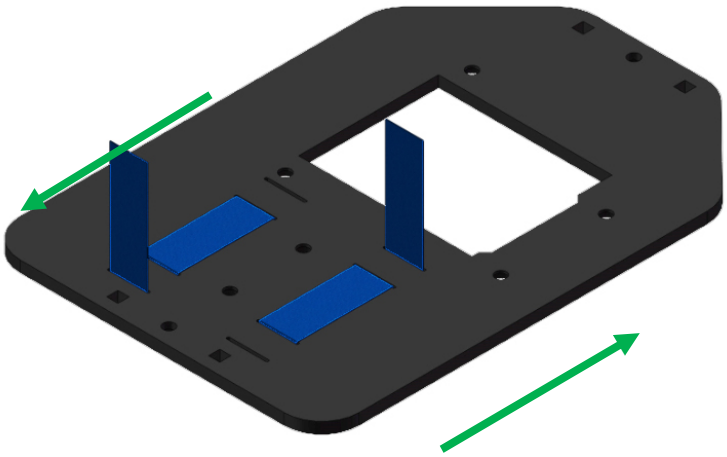
Click Finish.



# 5. Assembly

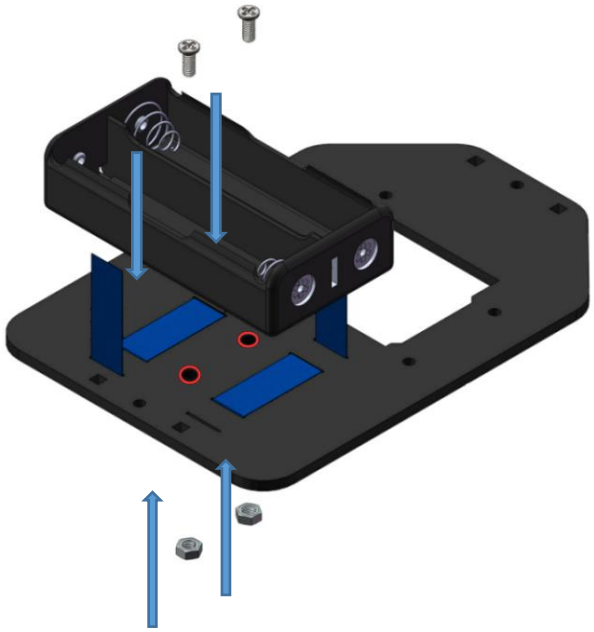
## 5.1 Base Bottom Plate + Riband

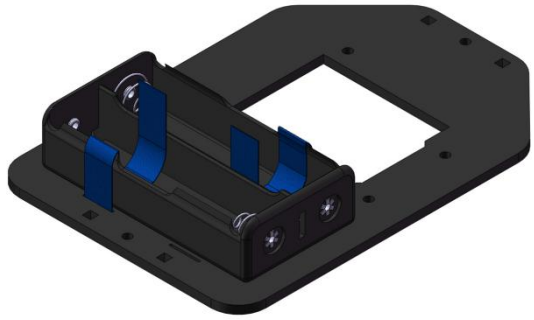
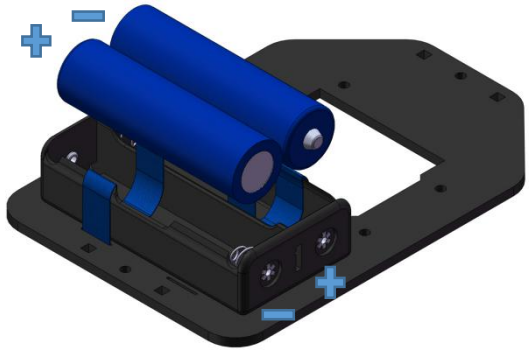
1. Cut the 50cm ribbon into halves. Thread the ribbon through the Acrylic plate. Leave the riband with one end of a long part and the other of a short one. Thread another riband through the base bottom plate.



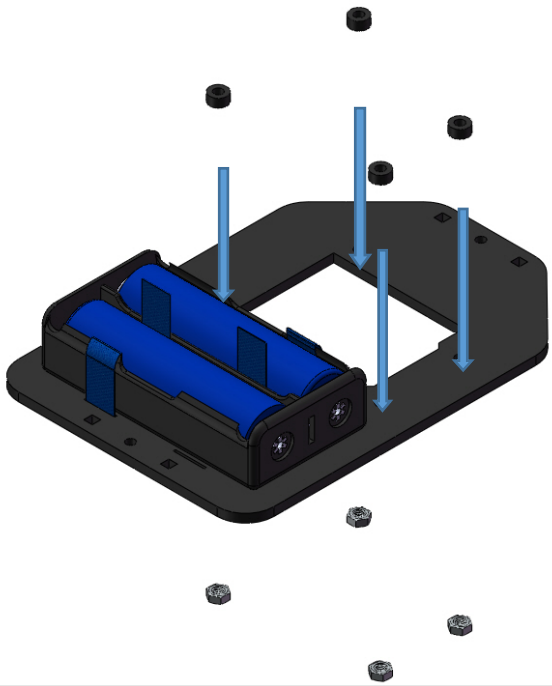
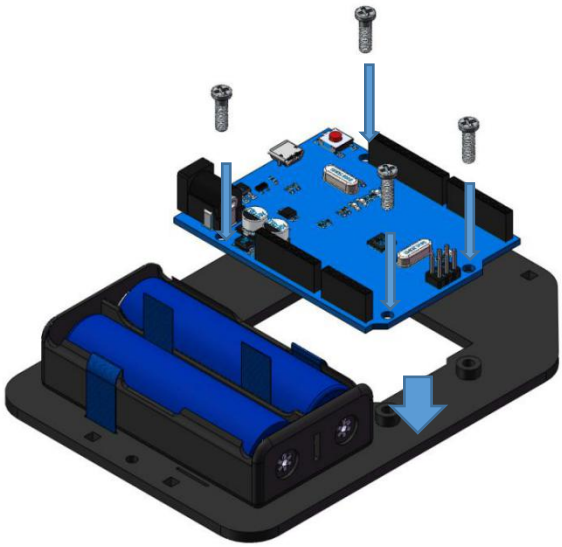
## 5.2 Base Bottom Plate + Battery Holder

1. Place the battery holder on the base bottom plate. Cling two M3 nuts underneath the plate and keep them aligned with the holes of the holder. Pay attention to put the end without holder power lines at the right side. Insert two M3*8 flat-head screws into the nuts and fasten them with the screw driver.

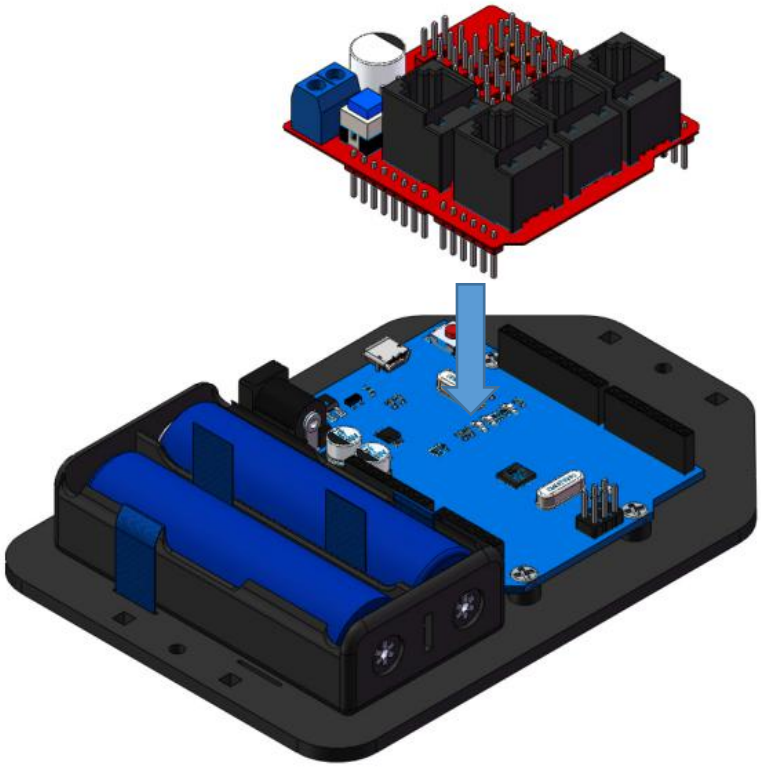


| | |
|---|---|
| 2. Fold the ribbon in the battery holder.<br>  | 3. Align the anode of the battery with that of the battery cover and so does the cathode. Insert the battery into the battery holder.<br>  |

## 5.3 Base Bottom Plate + Circuit Board

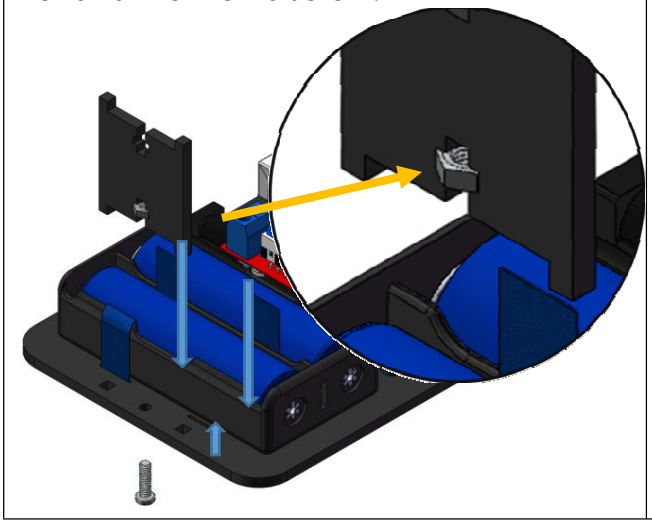
| | |
|---|---|
| 1. Align the acrylic washers and holes on the plate. Cling 4 M3 nuts to the holes underneath the plate.<br>  | 2. Place the UNO board onto the plate with its holes aligned with the washers. Fasten them with the M3*10 screws.<br>  |

3. Align the pin headers of the expansion board with the sockets of the UNO board.

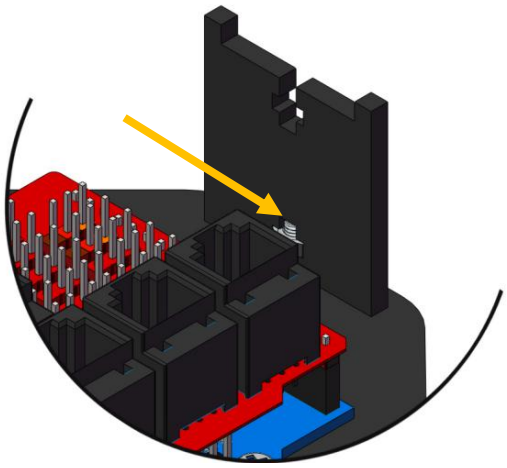


## 5.4 Base Bottom Plate + Base Fixing Plate

1. Put an M3 nut in the hole of the base fixing plate. Fix the two plates with the M3 nut and the M3*10 screw.

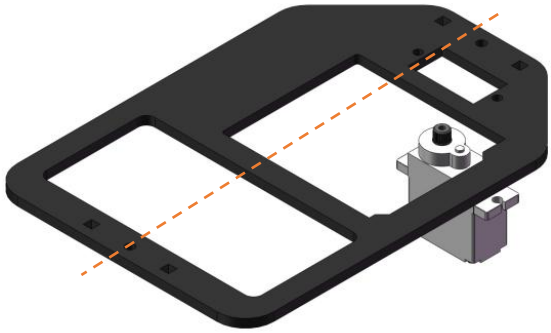


2. Mount the other base fixing plate in the same way.

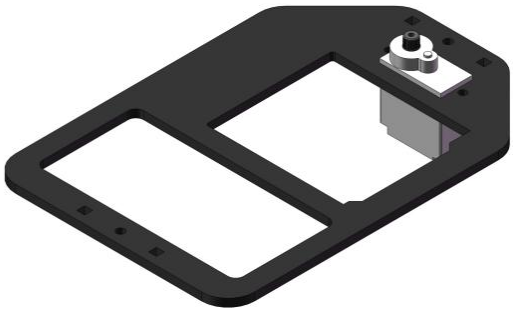


## 5.5 Base Upper Plate + Servo 1

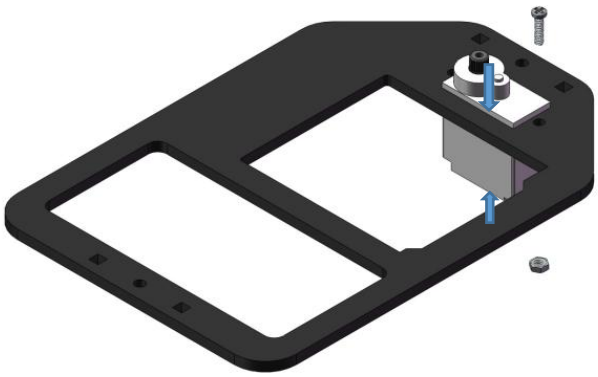
1. Align the servo with the slot of the base upper plate with the rotating axis close to the middle line of the base upper plate.



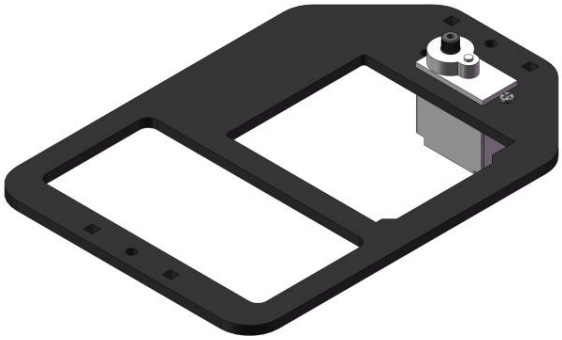
2. Insert the servo into the slot.



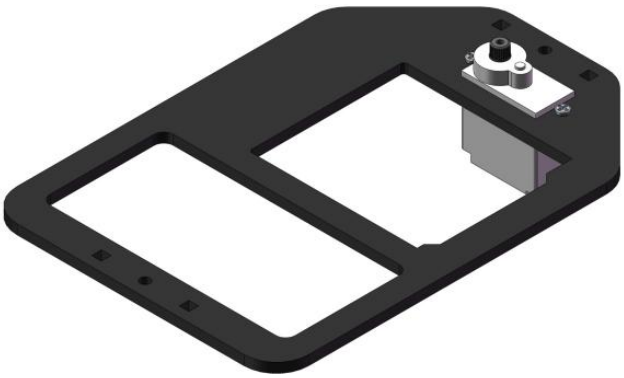
3. Hold an M2 nut underneath the hole of the servo and the upper plate and insert an M2*8 screw.



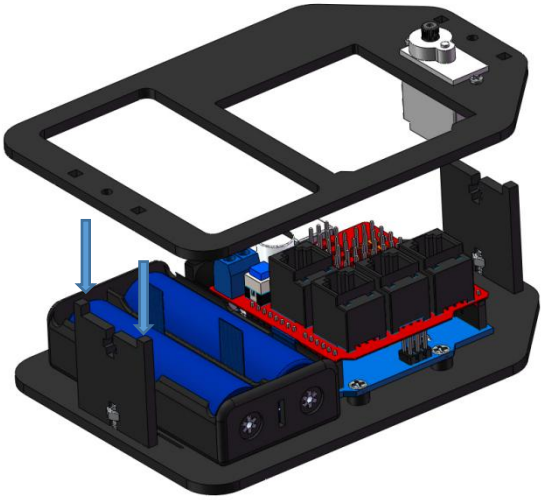
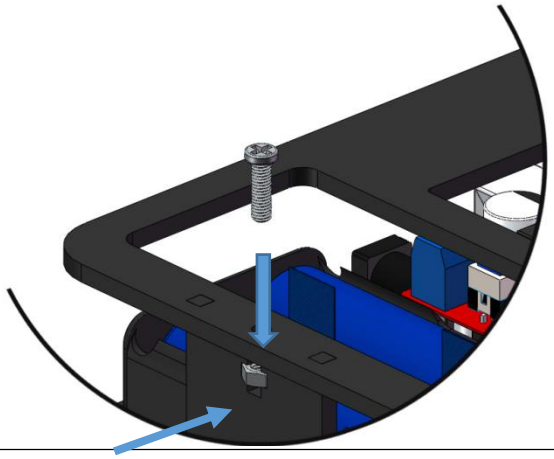
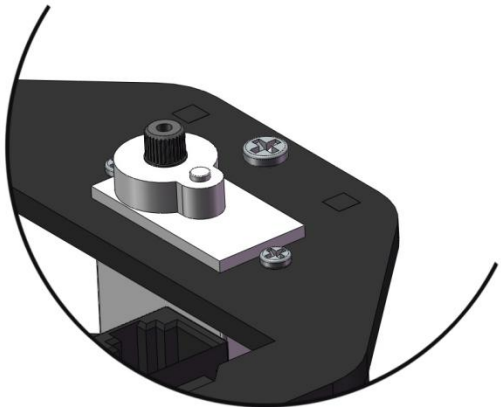
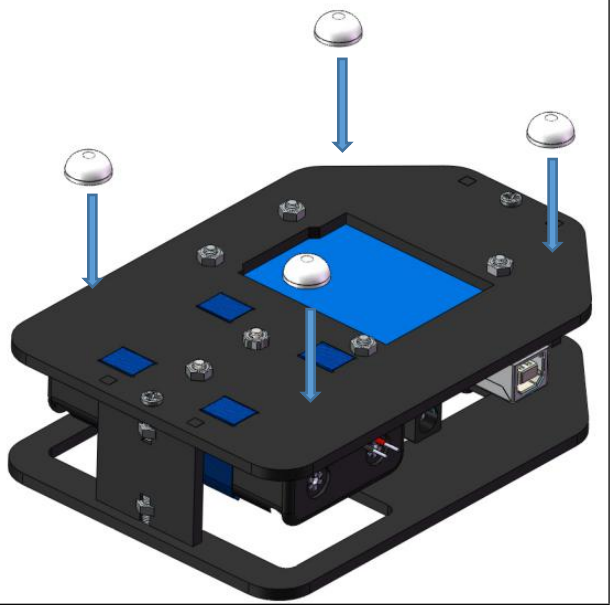
4. Fasten them with the screw driver.



5. Fasten the other screw and nut in the same way.

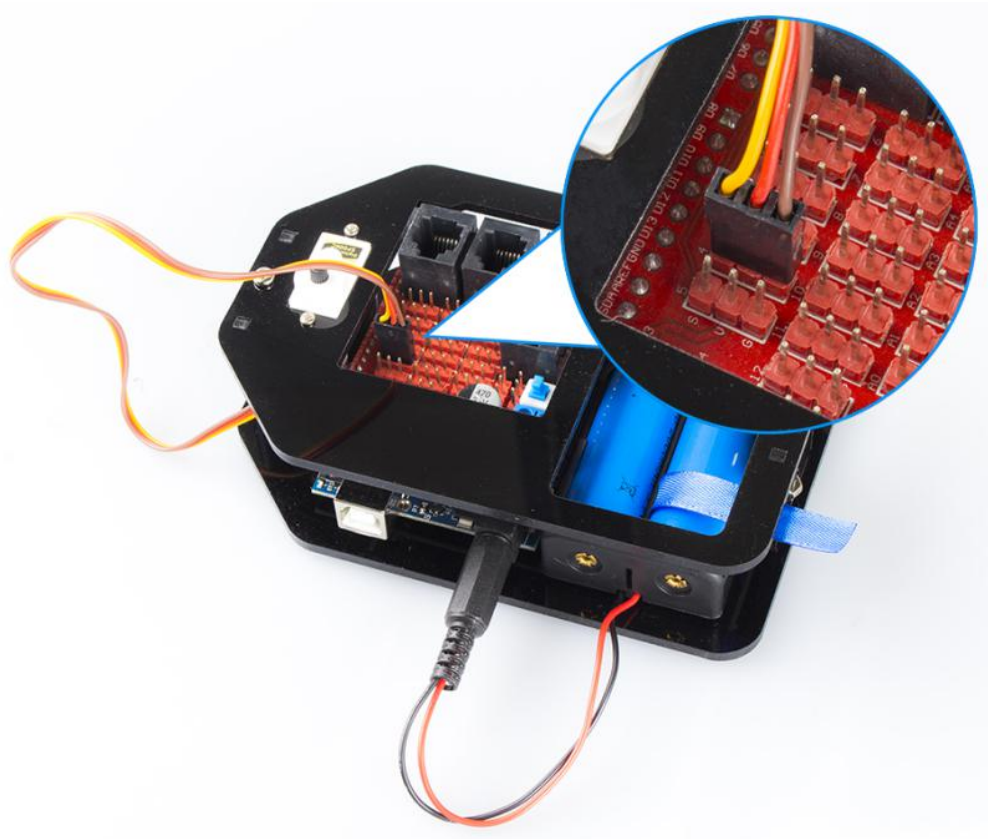


## 5.6 Base Fixing Plate + Base Upper Plate

| | |
|---|---|
| 1. Align the holes of the base upper plate with the bulges of the base fixing plate.<br>  | 2. Put an M3 nut in the hole of the base fixing plate, insert an M3*10 screw through the plate into the nut and fasten them with the screw driver.<br>  |
| 3. Fasten the other screw in the same way.<br>  | 4. Paste four non-skid pads onto the corners of the base bottom plate.<br>  |

## 5.8 Adjust the Servo 1

**Step 1**: Insert the servo wires into D4, connect the Servo Control Board to the PC via the USB cable, and the PC will automatically install the driver. The COM port connected will appear.

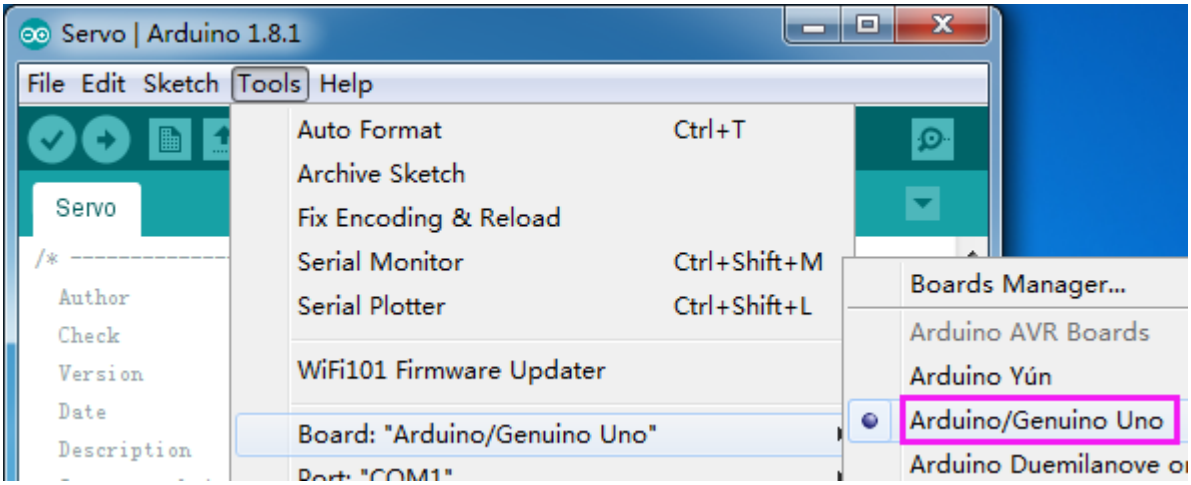


Connect the yellow, red, and brown wire to S, V, and G port as shown above.

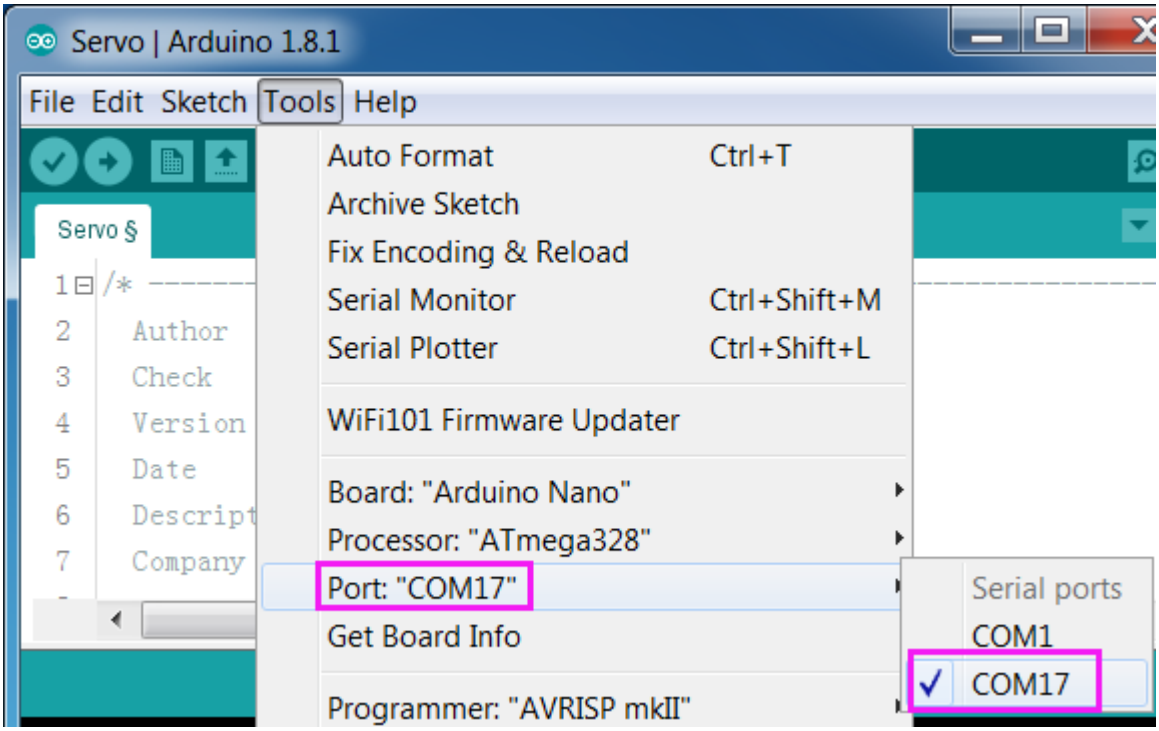
**Step 2**: Connect the Rollarm to your computer with the USB cable: the driver will be installed automatically at that time, then you can see COMxx in device manager.

**Step 3:** Go to the folder **DIY Control Robot Arm kit for *Arduino-Rollarm/Arduino Code /Servo*** and open the file Servo.ino.

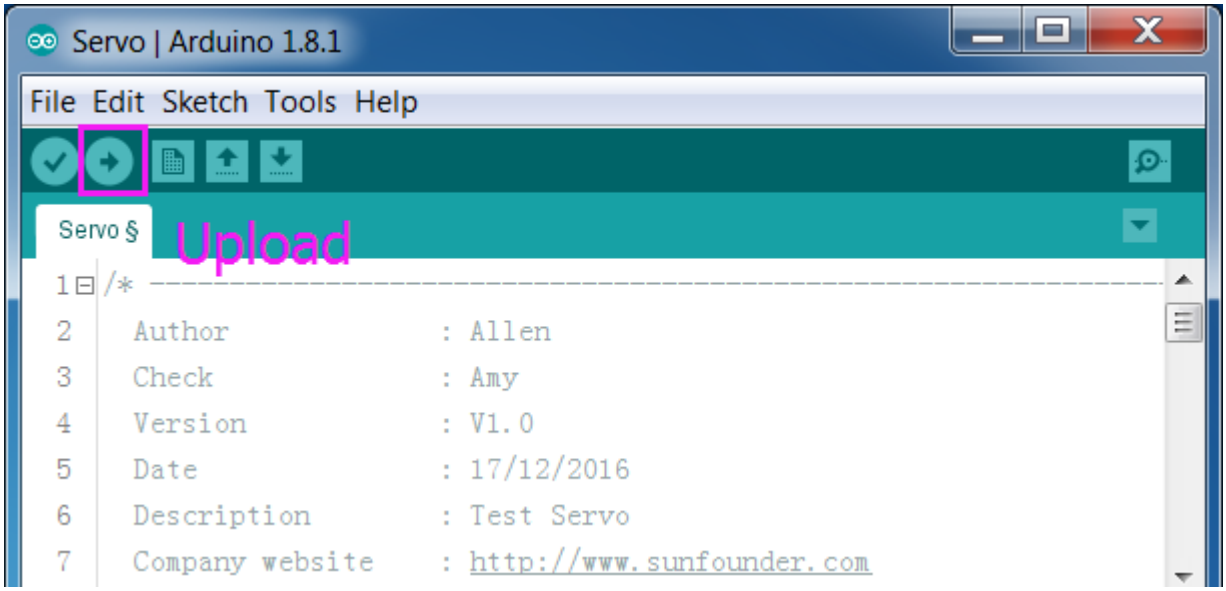
**Step 4**: Select the **Board.**



And **Port**.



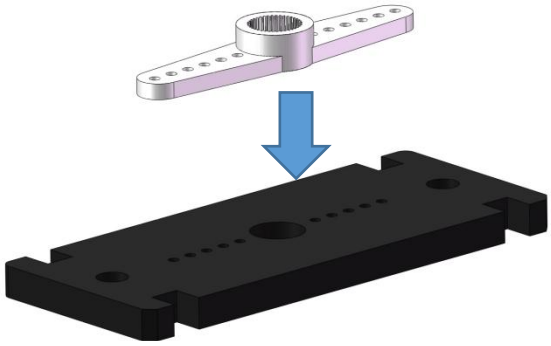

**Step 5**: Click **Upload**.



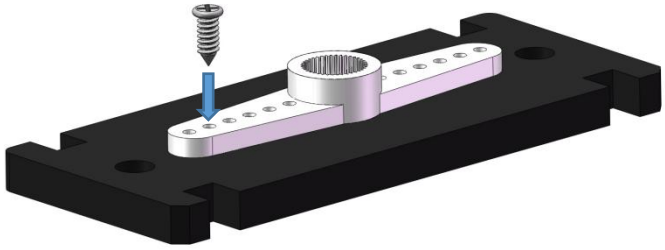

After the upload is completed successfully, press the switch on the board and **keep the control board power on**. You may hear the sound of gear moving (or may not, if the servo shaft happens to be at 90 degrees at the beginning; but you GENTLY spin the rocker arm and you'll find it's unmovable). So now the servo is adjusted to 90 degrees.

## 5.9 Joint 1-Connecting Plate + Servo Rocker Arm

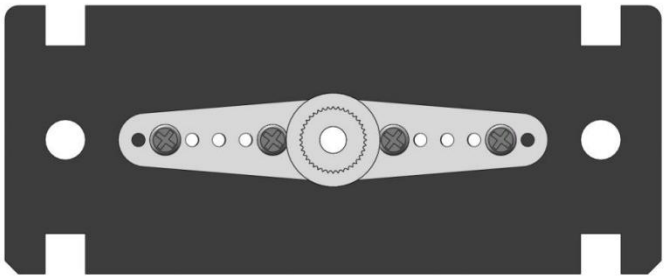
1. Align the servo rocker arm with the hole of the Joint 1-connecting plate.



2. Insert an M1.2*4 self-tapping screw into a hole of the plate through the rocker arm.

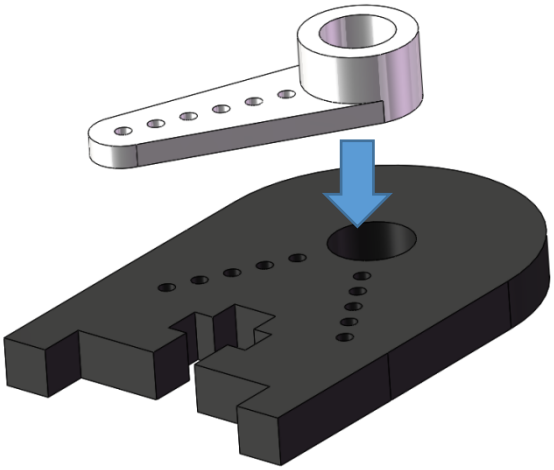


3. Fasten the other self-tapping screws in the same way.

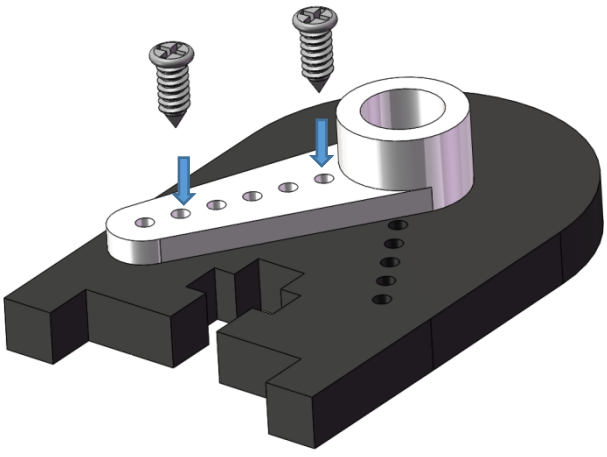


## 5.10 Right Joint Plate 1

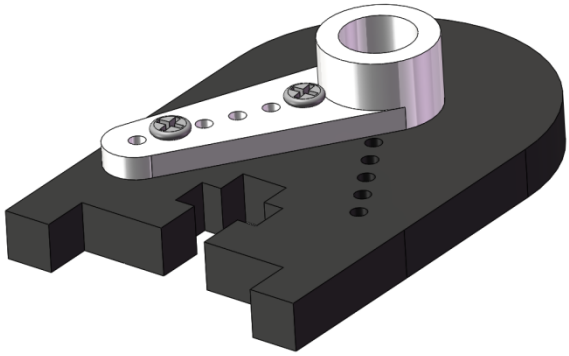
1. Align the servo rocker arm with the hole of the Right Joint Plate 1.



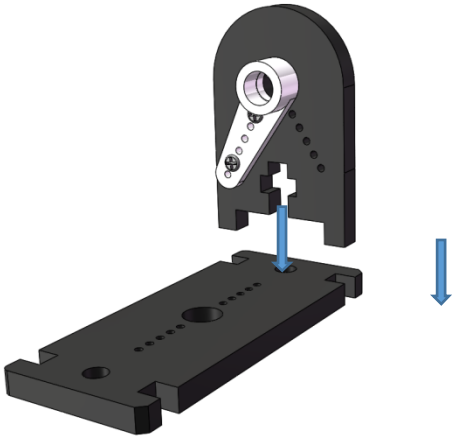
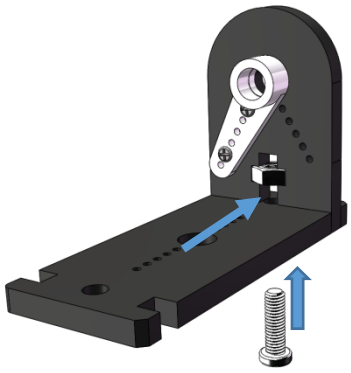
2. Insert an M1.2*4 self-tapping screw into a hole of the plate through the rocker arm.



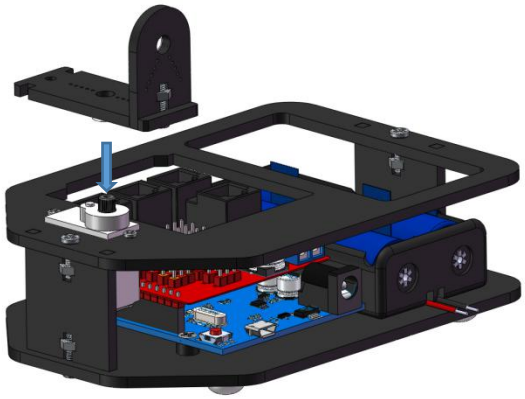
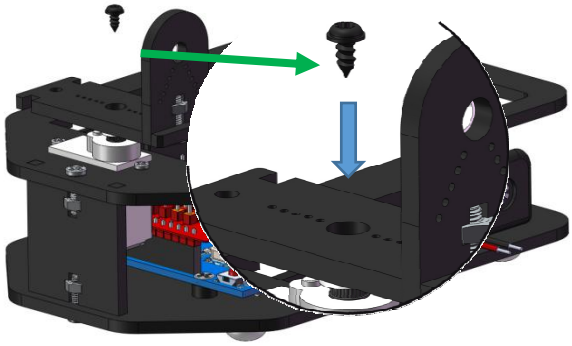
3. Fasten the other self-tapping screws in the same way.



## 5.11 Joint 1 Connecting Plate

| | |
|---|---|
| 1. Align the bulges of the Right Joint Plate 1 with the slots of the Joint 1 Connecting plate.  | 2. Put an M3 nut into the hole of the Right Joint Plate 1 and insert an M3*10 screw into the nut through the connecting plate.  |

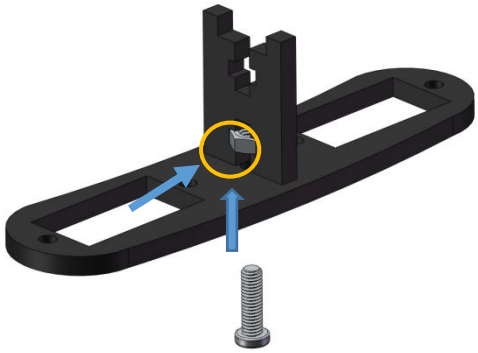
## 5.12 Base + Joint 1 Connecting Plate

| | |
|---|---|
| 1. Align the edge of the connecting plate with that of the base plate.  | 2. Fasten them with a servo screw(The shortest screw in the servo package).  |

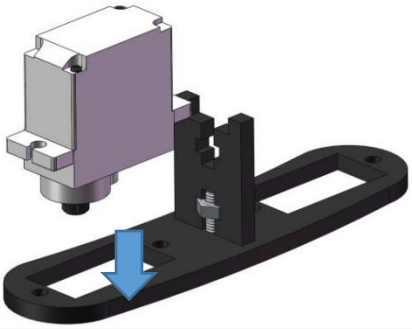
## 5.13 Joint 2 + Right Joint Plate 2

1. Align the bulges of the joint 2-connecting plate with the slots of the right joint plate 2.

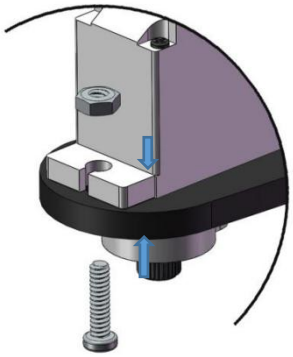
2. Put an M3 nut into the hole of the joint 2-connecting plate and insert an M3*10 screw into the nut.



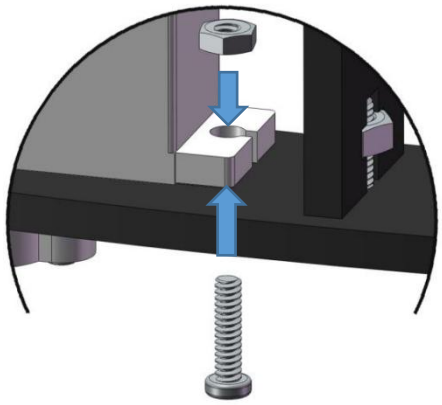
3. Align the servo 3 with the right joint plate Pay attention that the servo shaft should point to the plate end near the slot the servo to be placed in.



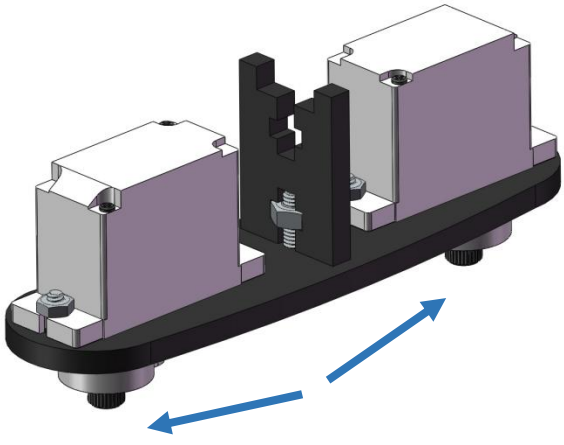
4. Put an M2 nut in the hole of the servo and insert an M2*8 screw into the nut and fasten them.

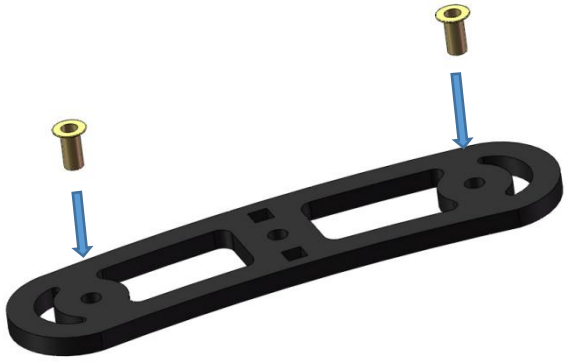
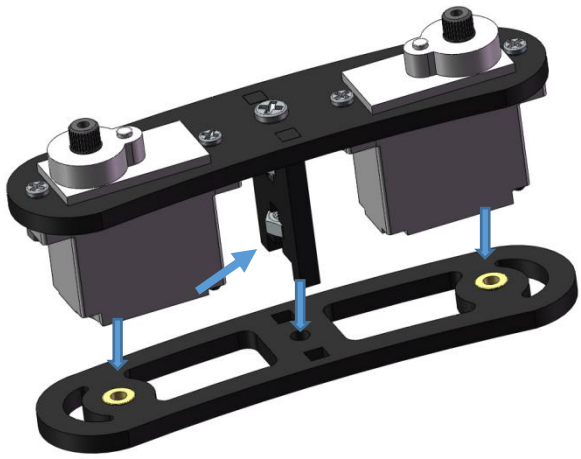
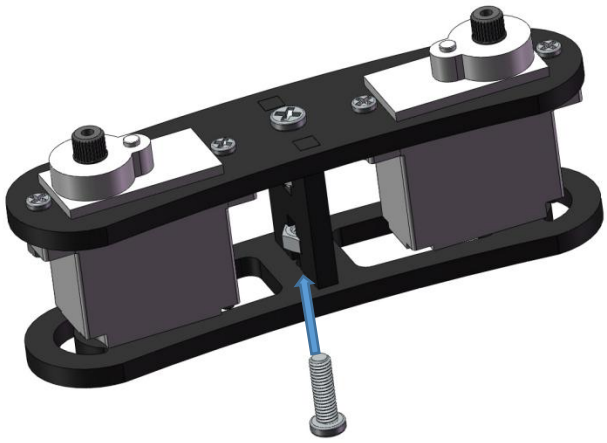


5. Fasten the other screw in the same way.



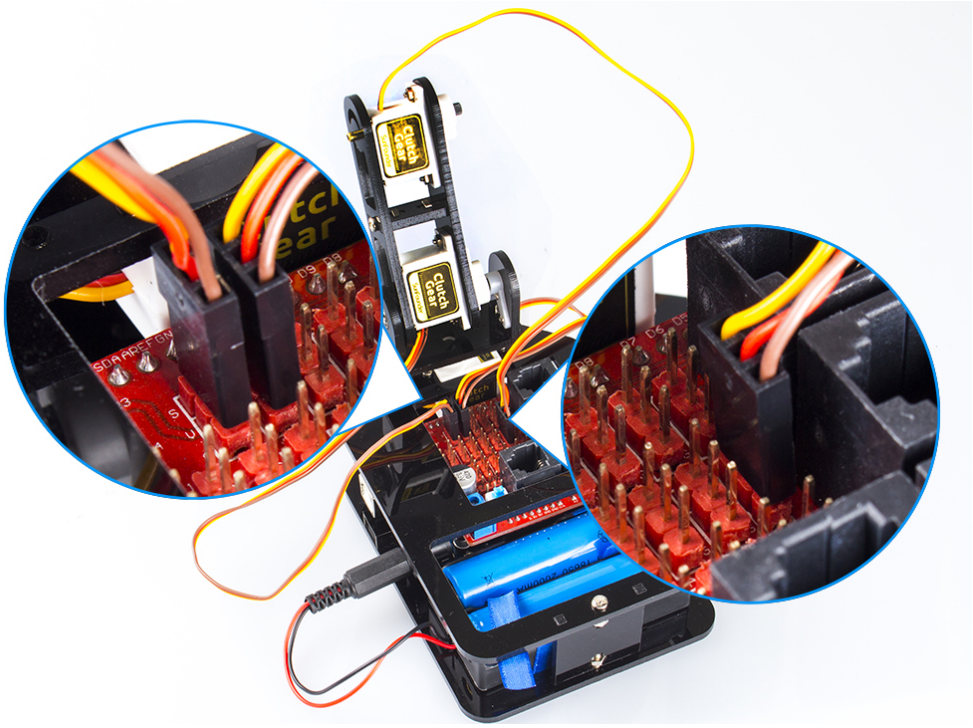
6. Fix the servo 2 in the same way.



| | |
|---|---|
| 7. Align the two M3*6 copper corn rivets with the holes of the left joint plate 2.<br>  | 8. Insert the rivets into the holes of the plate.<br>  |
| 9. Put an M3 nut in the hole of the joint 2-connecting plate. Align the bulges of the plate with the slots of the left joint plate 2.<br>  | 10. Insert an M3*10 screw into the nut and fasten them with the screw driver.<br>  |

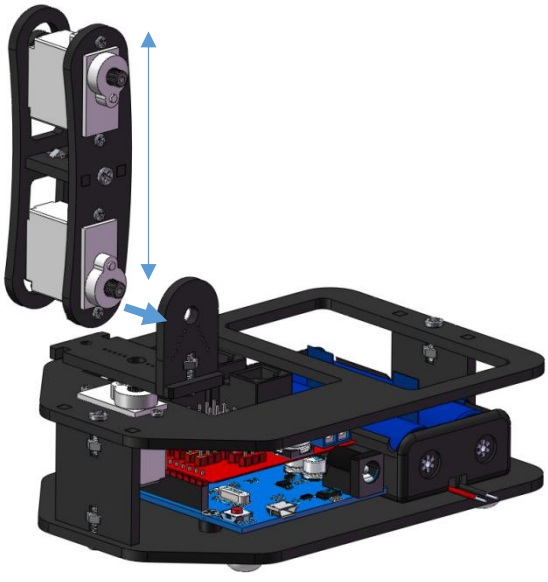
## 5.14 Adjust The Servo 2 and The Servo 3

Connect the servo 2 to port D5 of the expansion board, while the servo 3 to port D6. Power on the servos, then it will be rotate to its 90° position. In following steps, you still need to keep the power on.

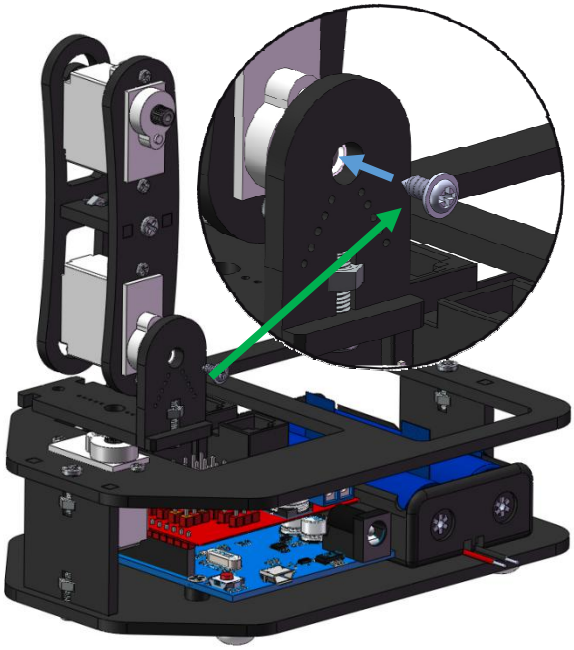


## 5.15 Joint 1 Connecting Plate + Joint 2 Connecting Plate

1. Align the servo shaft with the round rocker arm connected to the joint 1-connecting plate. Remember the servo should be vertically placed as shown below.



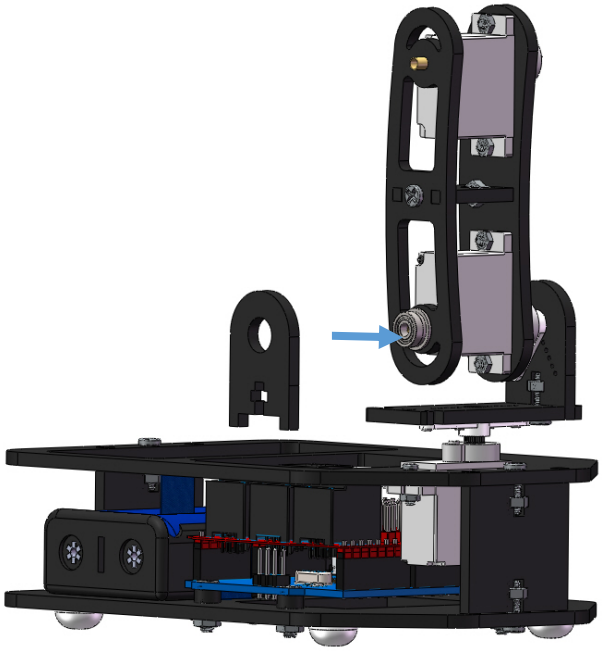
2. Fasten them with a servo screw(The shortest screw in the servo package).



# 5.16 Joint 1 Connecting Plate

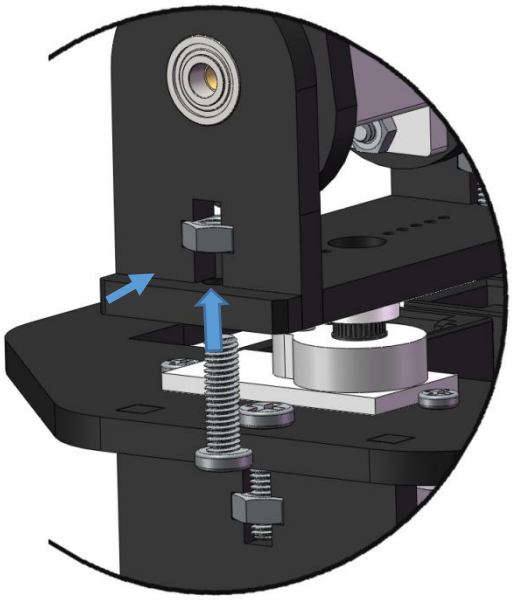
1. Align the band edge bearing with the corn rivet. Put the bearing into the rivet.

2. Insert the bulges of the left joint 1 into the slots of the joint 1-connecting plate and insert the bearing into the hole of the former.



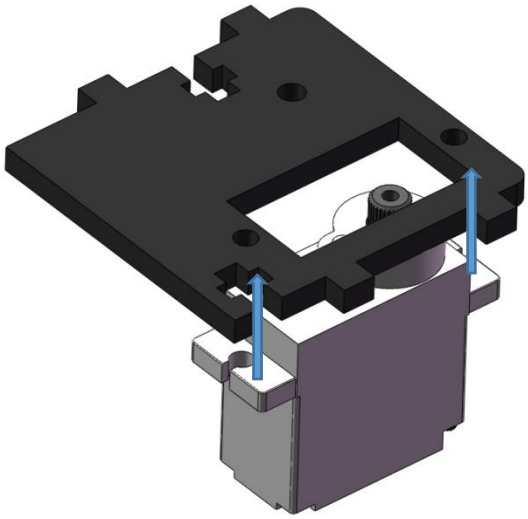
3. Turn the power switch off. Rotate the joint 1-connecting plate 90 degrees anticlockwise.

4. Put an M3 nut in the hole of the left joint connecting plate 1 and insert an M3*10 screw into the nut and fasten them.

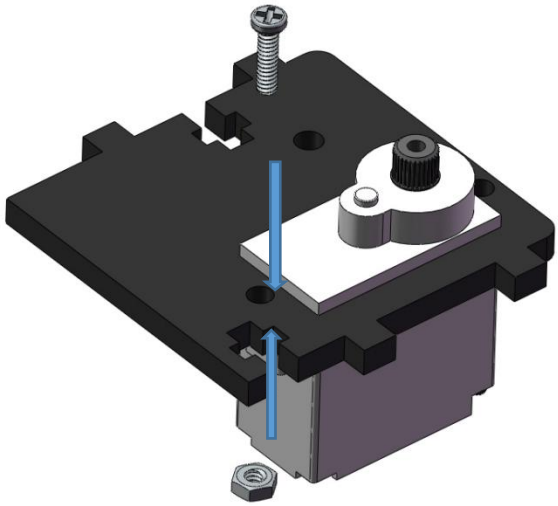


# 5.17 Gripper Fixing Plate

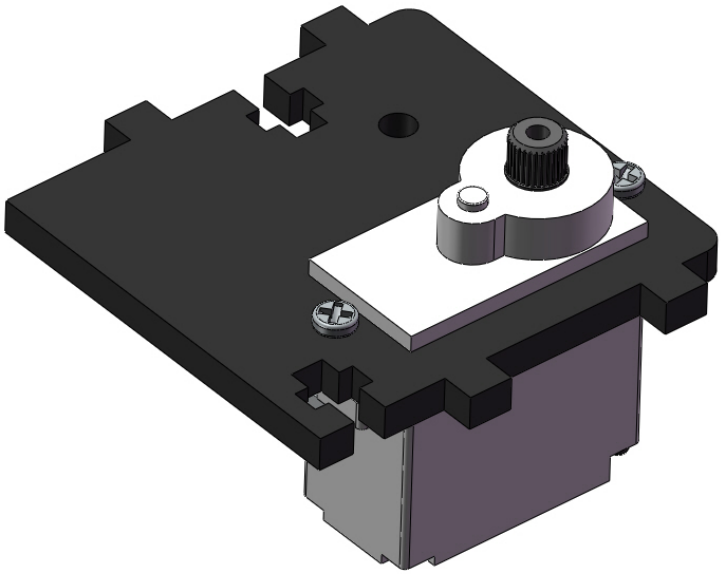
1. Align the servo4 with the slot of the gripper fixing plate (pay attention to the direction of the shaft).



2. Put an M2 nut underneath the hole and hold it with your finger, and insert an M2*8 screw into the nut and fasten them.

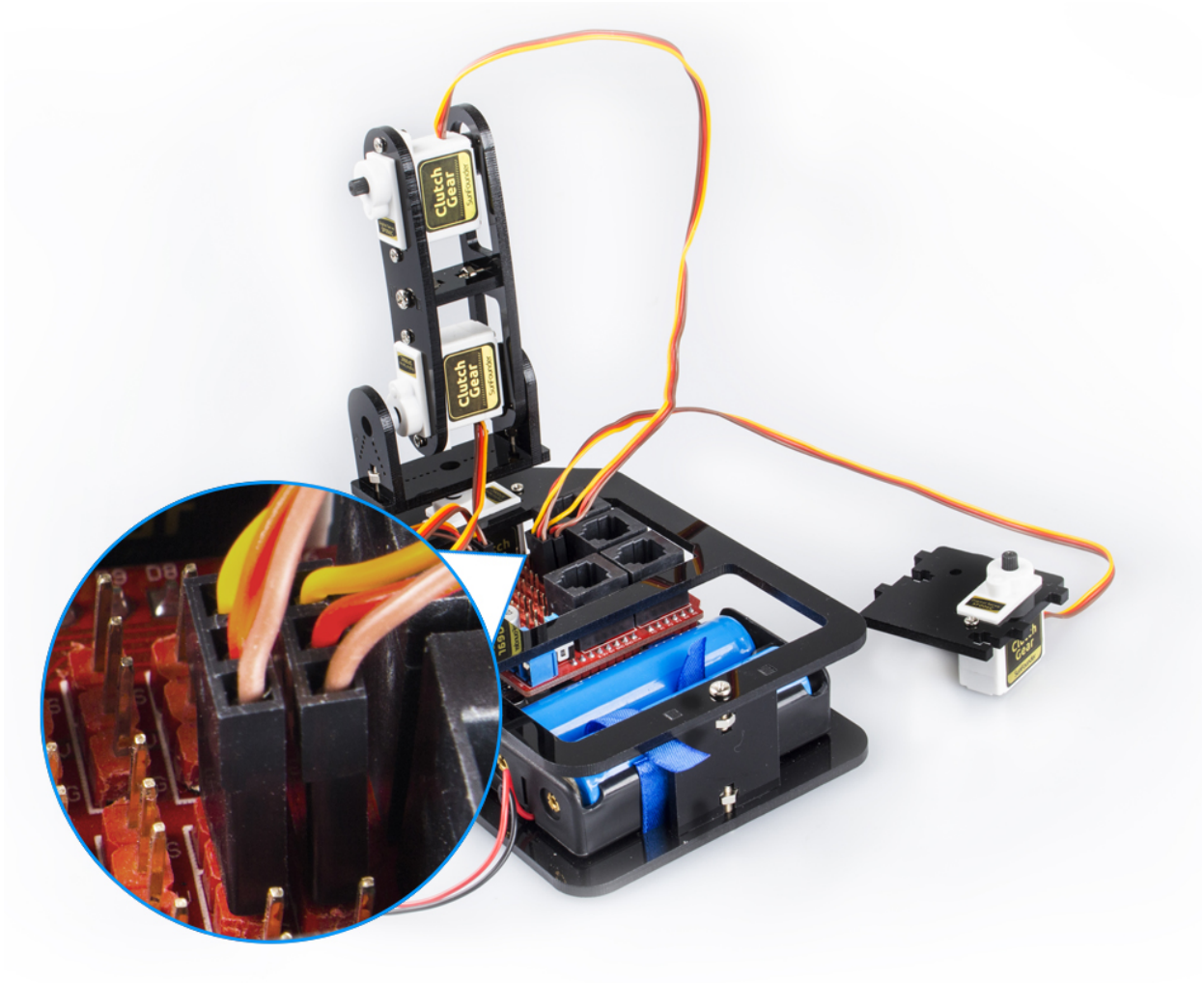


3. Fasten another screw in the same way.

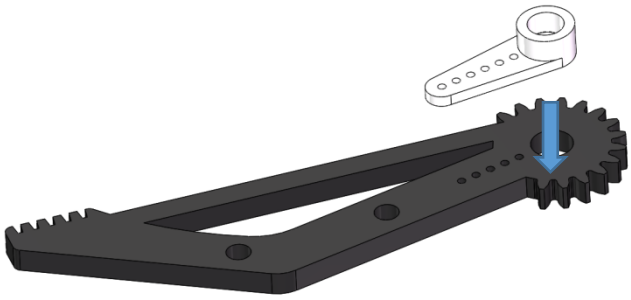
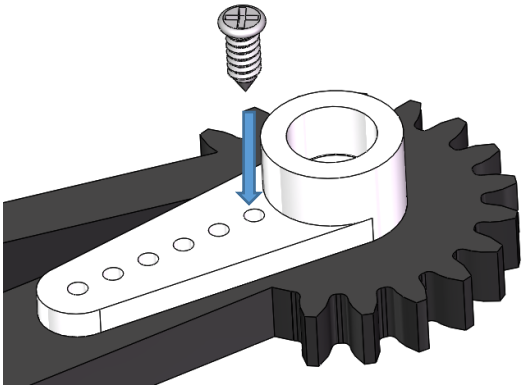


## 5.18 Adjust The Servo 4

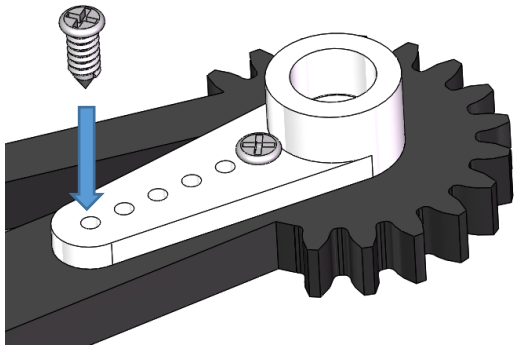
Connect the servo 4 to the port D7 of the expansion board, then power on the servo, then the servo will rotate to its 170 position.



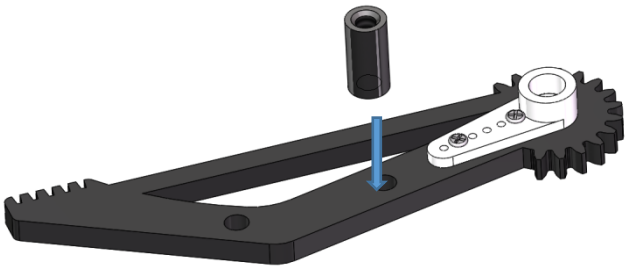

## 5.19 Gripper Driving Plate + Gripper Driven Plate

| | |
|---|---|
| 1. Align the servo rocker arm with the hole of the gripper driving plate.  | 2. Insert an M1.2*4 self-tapping screw into the first hole of rocker arm.  |

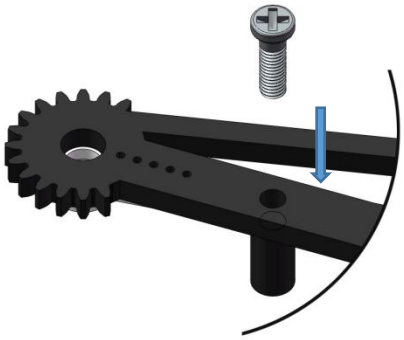
3. Insert an M1.2*4 self-tapping screw into the last hole and fasten them.



4. Align an M3*10 aluminum tube with the rest hole of the plate.



5. Insert an M3*8 screw into the tube from the other side of the plate.

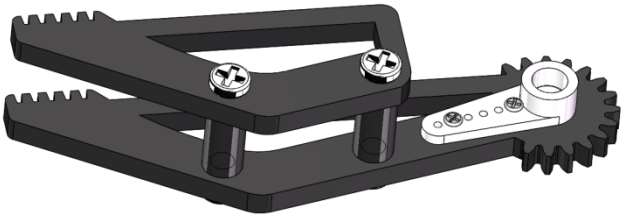


6. Fix another aluminum tube similarly.

7. Align the holes of the gripper assistant with the aluminum tubes.

8. Fasten them with an M3*8 screw.

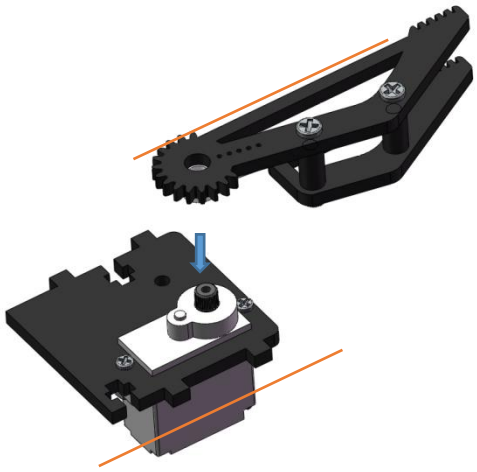
9. Fix an M3*8 screw to the other tube.



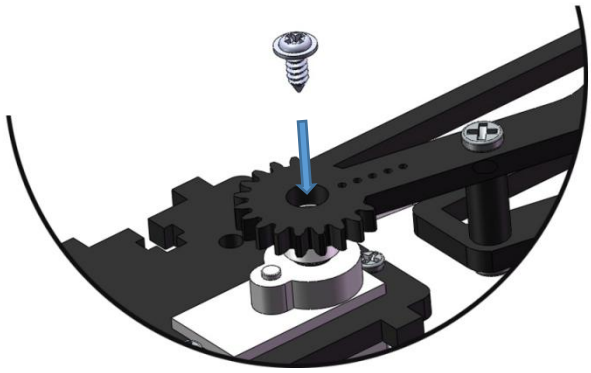
10. Install the gripper driven plate in the same way.

# 5.20 Grippers + Gripper Fixing Plate

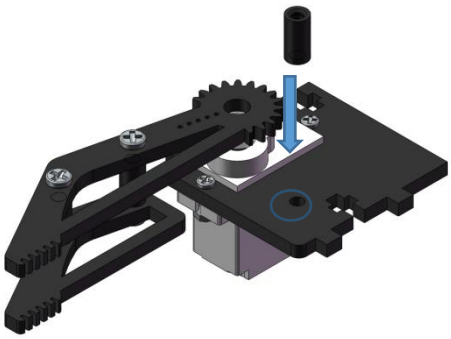
1. Align the servo rocker arm with the shaft and keep the gripper edge of the driving plate parallel to the side of the fixing plate.



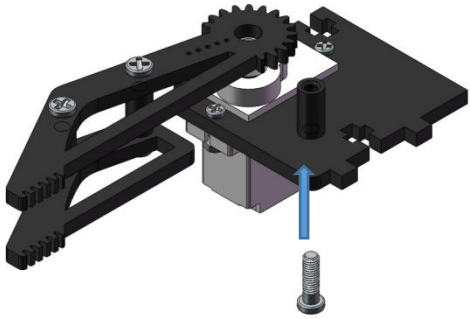
2. Fasten them with a servo screw(The shortest screw in the servo package).



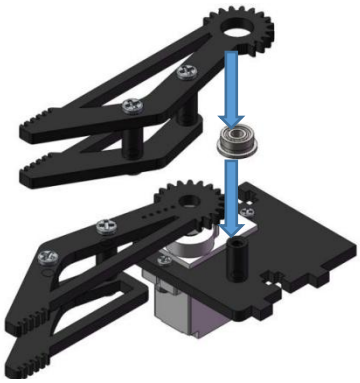
3. Align the aluminum tube with the hole of the gripper fixing plate.



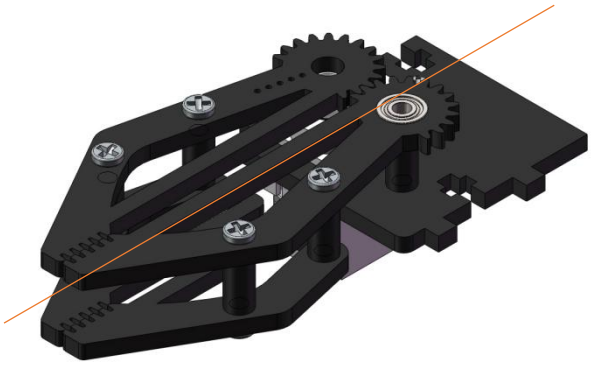
4. Insert an M3*8 screw into the hole.

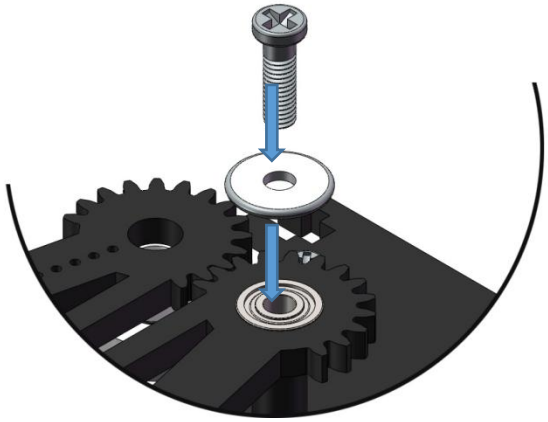
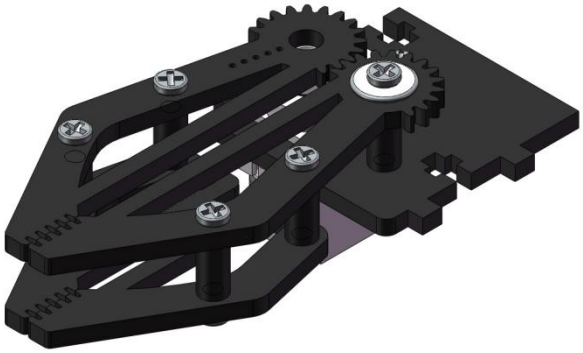


5. Align a band edge bearing with the aluminum tube with the edge against the tube. Put the gripper driven plate onto the bearing.

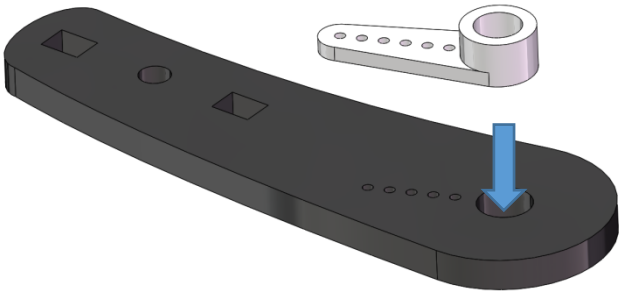
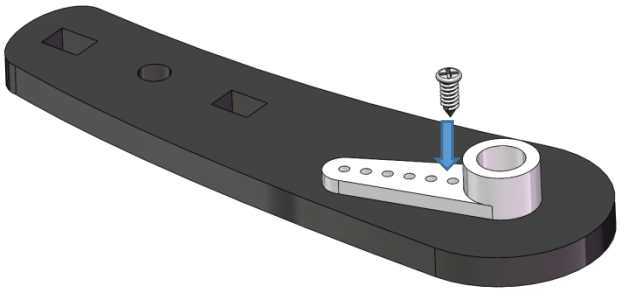
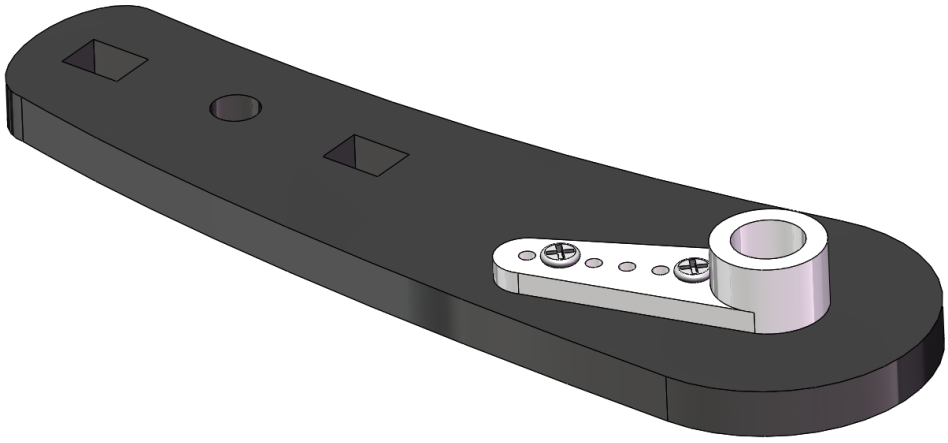


6. Keep the inner edges of the two gripper plates parallel and the gears meshed.

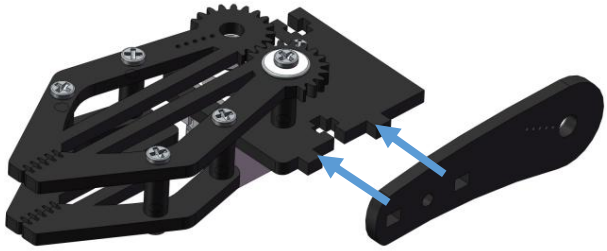
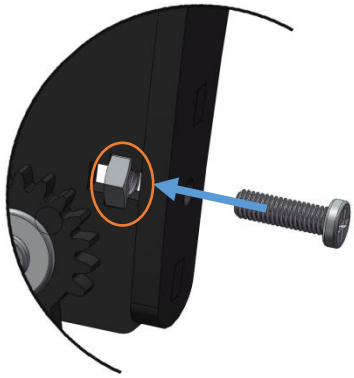


| | |
|---|---|
| 7. Put a 3*10*1 washer on the bearing and fasten them with an M3*8 screw.<br>  | 8. It will be like this after fastening.<br>  |

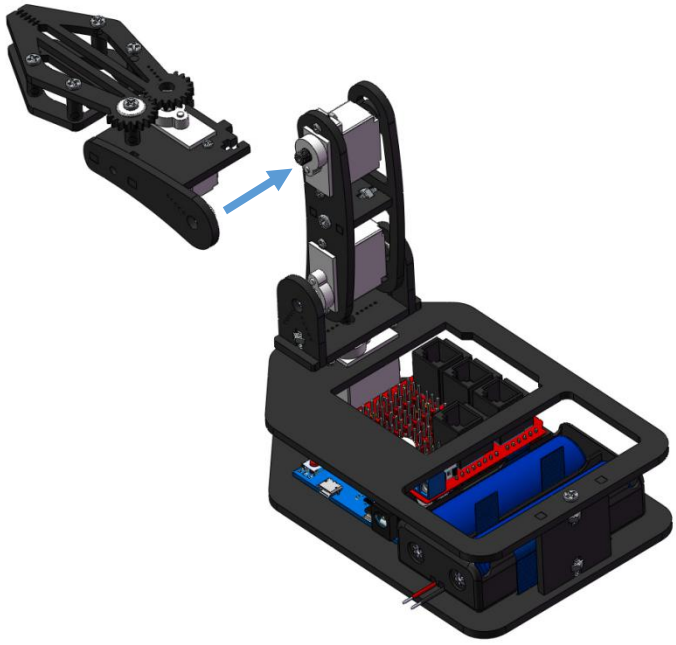
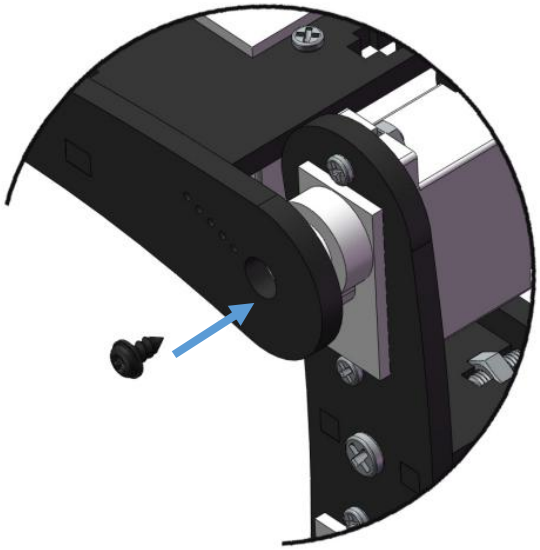
## 5.21 Right Joint Plate 3

| | |
|---|---|
| 1. Align the servo rocker arm with the hole of the Right Joint Plate 3.<br>  | 2. Insert an M1.2*4 self-tapping screw into a hole of the plate through the rocker arm.<br>  |
| 3. Fasten the other self-tapping screws in the same way.<br>  | |

## 5.22 Gripper Fixing Plate + Right Joint Plate 3

| | |
|---|---|
| 1. Align the bulges of the gripper fixing plate with the slots of the right joint plate.<br>  | 2. Put an M3 nut in the hole of the gripper fixing plate and insert an M3*10 screw into the nut.<br>  |

## 5.23 Joint 2 Connecting Plate + Joint 3 Connecting Plate

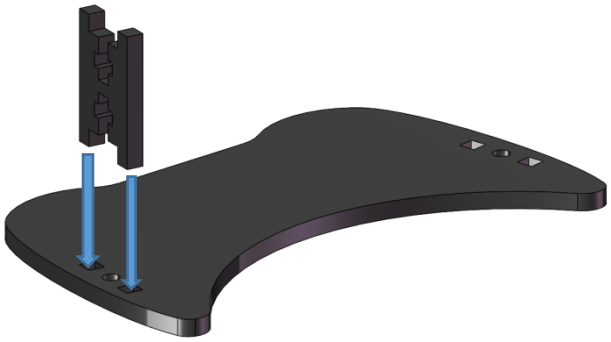
| | |
|---|---|
| 1. Align the servo rocker arm with the shaft and keep the two joint plates near perpendicular to each other.<br>  | 2. Fasten them with a servo screw(The shortest screw in the servo package).<br>  |

# 5.24 Left Joint Plate 3

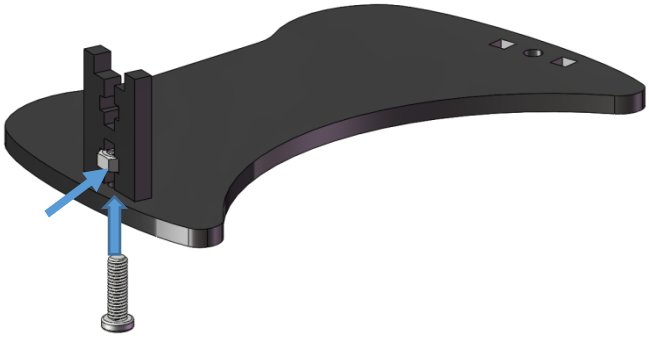
| | |
|---|---|
| 1. Align the band edge bearing with the corn rivet with its edge against the plate.<br>  | 2. Align the hole of the left joint plate 3 with the bearing.<br>  |
| 3. Put an M3 nut in the hole of the fixing plate and insert an M3*10 screw into the nut.<br>  | 4. Fasten them with the screw driver.<br>  |

# 5.25 Handle

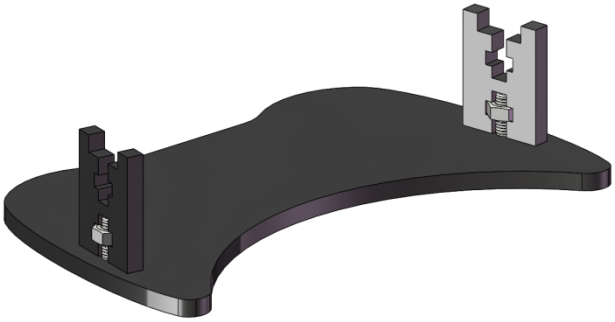
1. Align the bulges of the handle-fixing plate with the slotted holes of the handle-bottom plate.



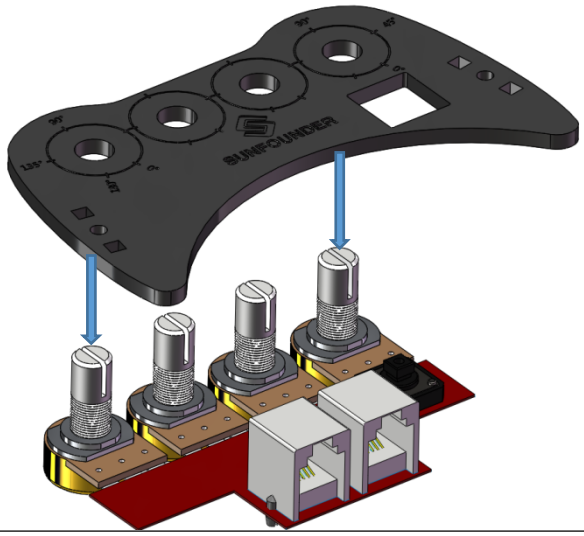
2. Put an M3 nut in the hole of the fixing plate and insert an M3*10 screw into the nut.



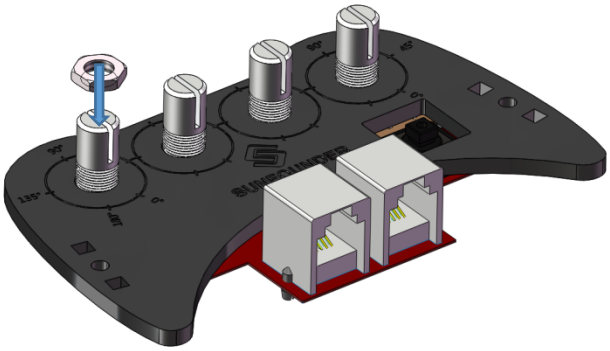
3. Fix the other handle fixing plate in the same way.



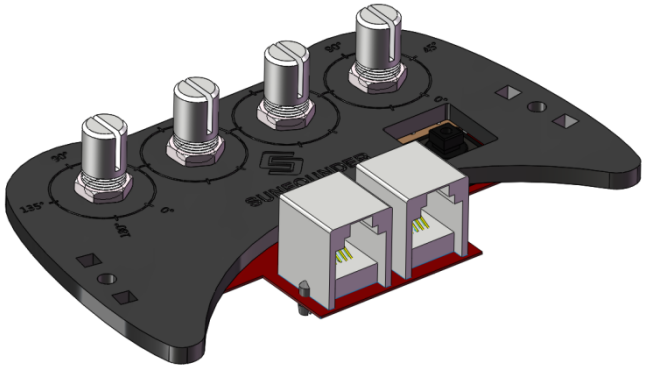
4. Align the four holes of the handle upper plate with the 4 potentiometers on the Potentiometer Module.



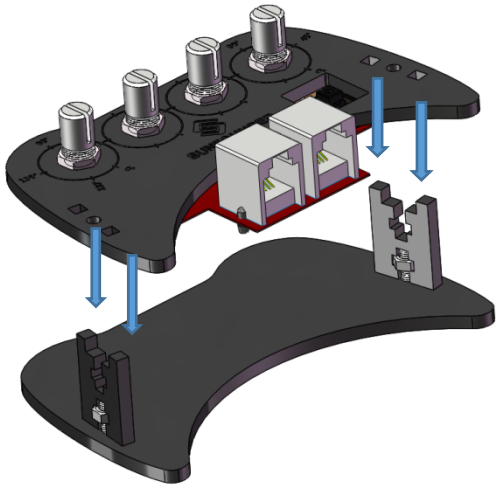
5. Fasten one pot with an M7 thin nut.



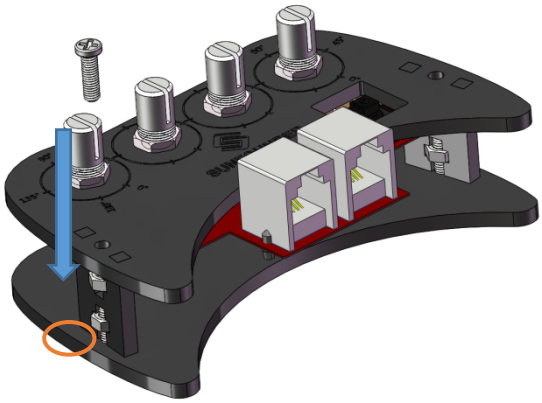
6. Fasten the other three pots with the M7 thin nuts in the same way.



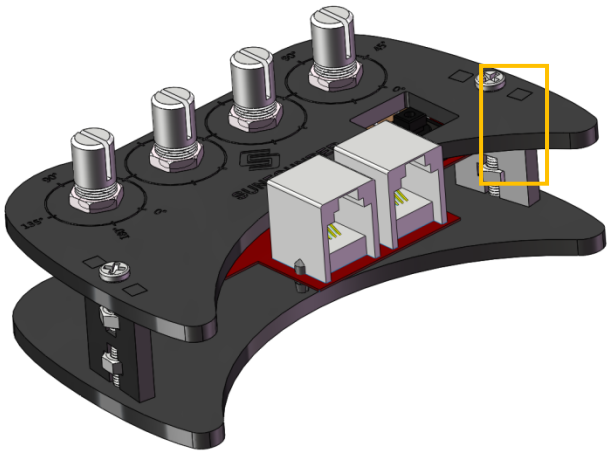
7. Align the slotted holes of the handle upper plate with the bulges of the handle fixing plate.



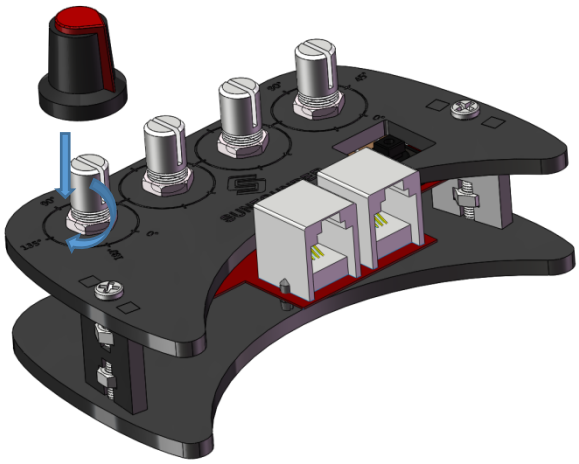
8. Put an M3 nut in the hole of the handle fixing plate and insert an M3*10 screw into the nut.



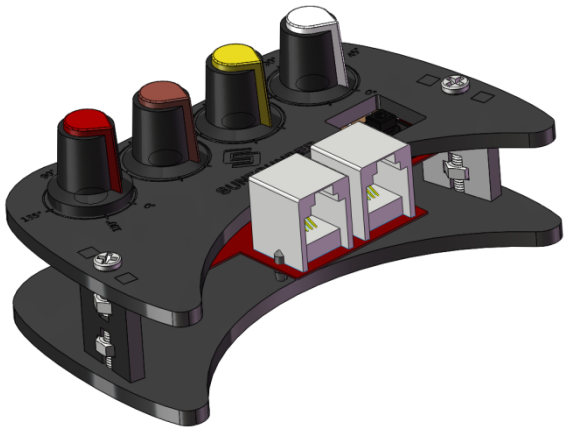
9. Fasten the other screw similarly.



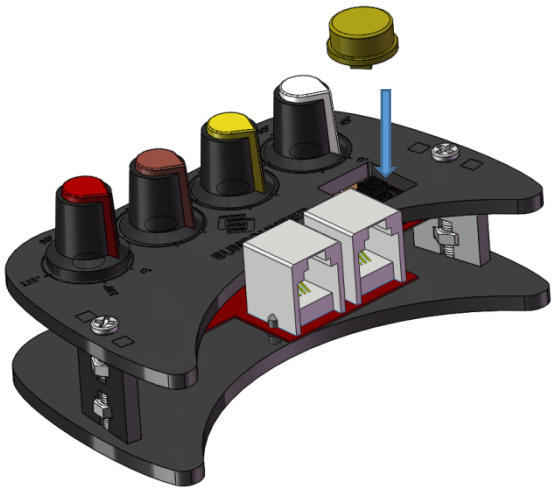
10. Rotate the potentiometer clockwise to the end, and align the bulged part of button with the 0 ° position. Put the button onto the potentiometer.



11. Install the other three pot buttons in the same way.

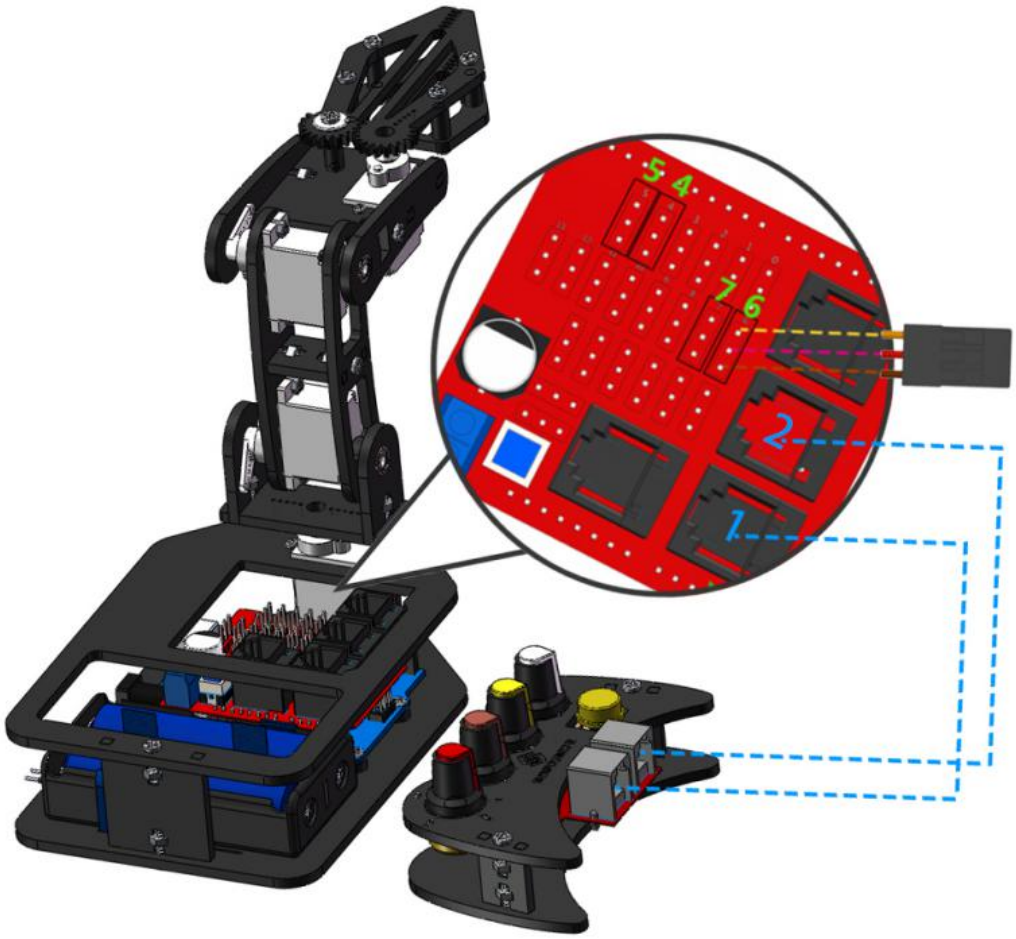


12. Install the button.



# 5.26 Wiring

In this step, connect port1 and 2 of the handle to that of the extension board with RJ11 cables.




Notes:

1. Before connecting the servo wires to the ports, turn off the power. Turn it on again after all the wires are connected.

2. When the servos are on, remember NOT to rotate the servo rocker arms. Turn them off if you want to do so.

3. Please be careful that the servos shouldn't be kept stalling. Otherwise, it will cause damages. In a word, when you are not running the Rollarm, keep it OFF.

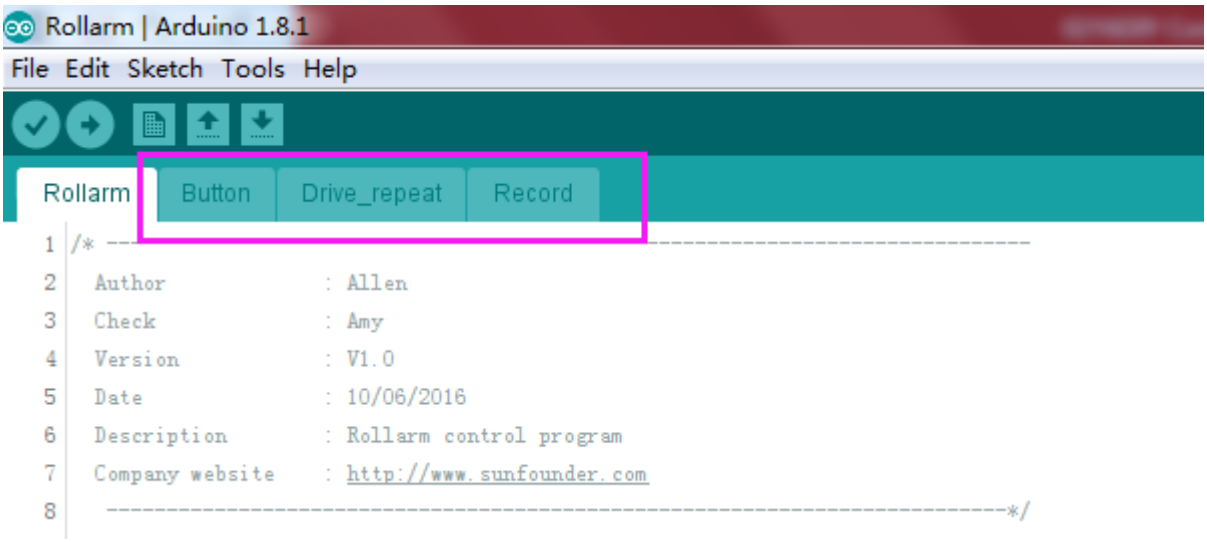
# 6. Control the Rollarm

There are two ways to control the Rollarm: manual control (by handle), or PC control (by Labview). The detailed operations for two ways are as follows.

## 6.1 Manual Control

**Step 1**: Run the *Rollarm.ino* file under the path *DIY_Control_Robot_Arm_kit_for_Arduino-Rollarm\Arduino Code\Rollarm*. There are four code files in Rollarm, **Rollarm.ino** is the main program, when the others are subprograms.

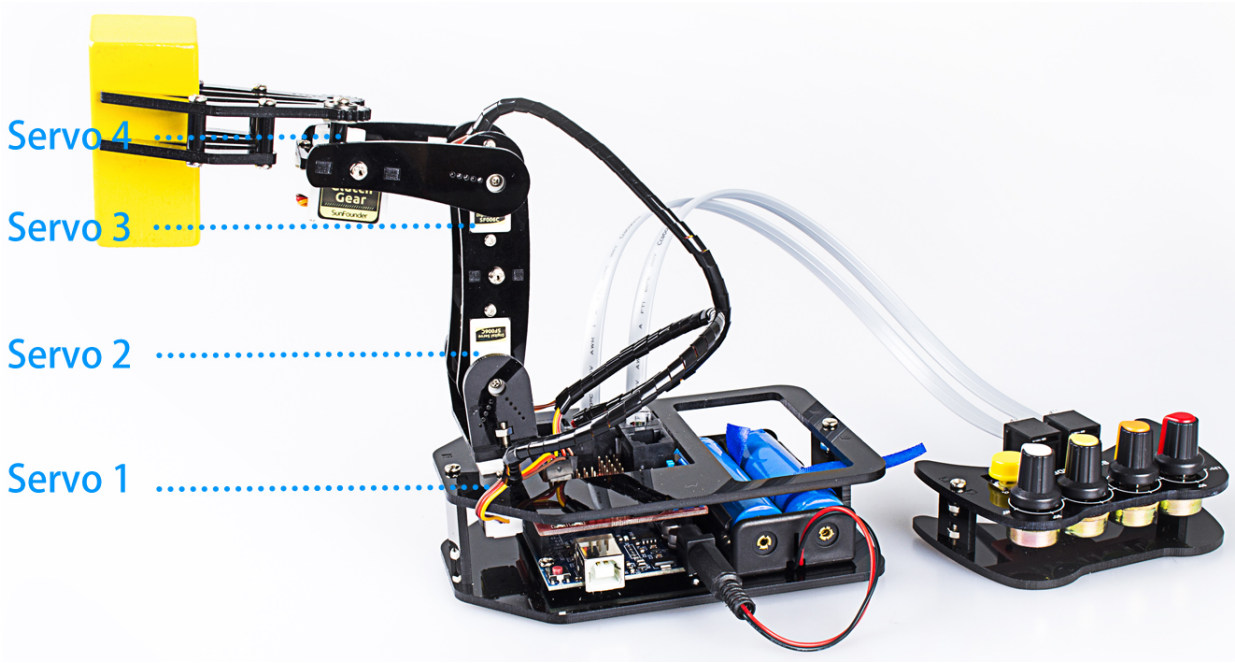

When you open the main program, the subprograms will be opened automatically:




**Step 2**: Select the corresponding board and port, then click **Upload.**

**Step 3**: After the code upload, turn the power switch on, then we can try to control the Rollarm.

**Step 4**: Rotate the four potentiometer buttons in different colors to try the controlled servo and direction: the white button to control the Servo 4, the yellow to Servo 3, the orange to Servo 2, and the red one to control Servo 1.



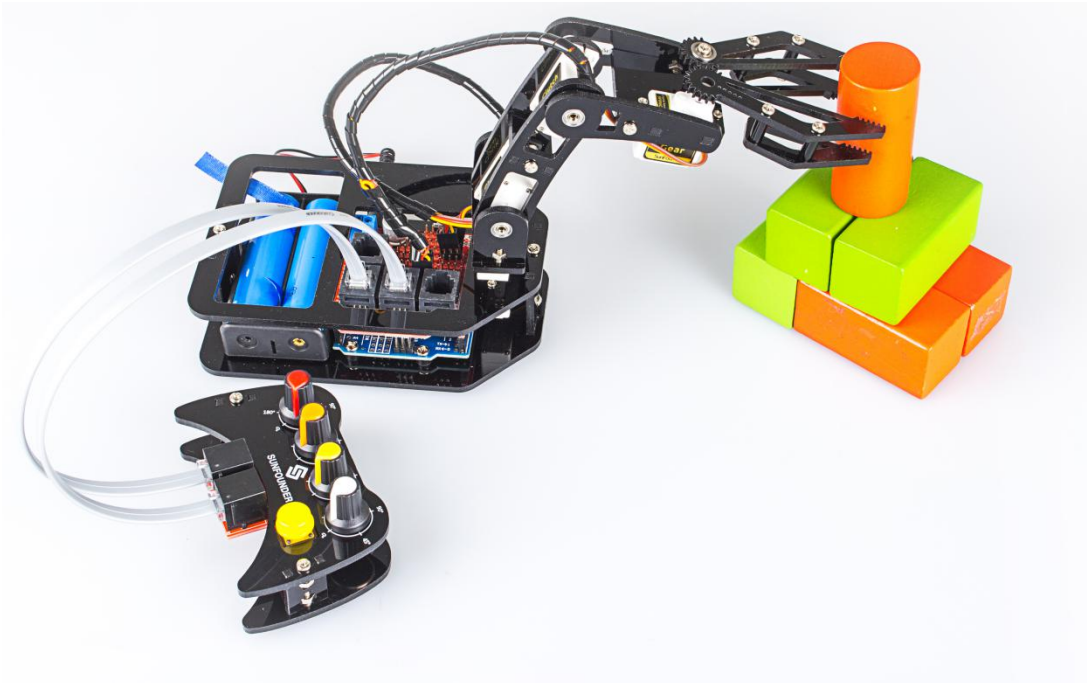

### 6.1.1 Recording behavior

With the handle, the Rollarm can record its behaviors:

Rotate one potentiometer button to control one servo to the desired position, and press the yellow button shortly to let the control board record this step. Record the rest steps in this way.

When all the steps are done, press and hold the yellow button for a while (3s). So it will repeat the recorded steps (Rollarm can record at most 100 steps because of the control board's memory limit).

Thus we can make it automatically carry blocks continuously:



## 6.1.2 Code Explanation

The program includes three parts: rotating the potentiometers to control the Rollarm, pressing the button slightly for less than one second to record Rollarm's behaviors and pressing the button for a relatively longer time to make Rollarm repeat the recorded steps.

There are four potentiometers to control the arms. The 4 servos from top to bottom are connected to port 4-7 respectively of the expansion board, and the 4 potentiometers control the ports accordingly. In other words, spin the white potentiometer to control the bottom servo, the yellow to control the next servo below, the orange to control the next servo, and the red one to control the uppermost servo.

Since the Rollarm has four servos acting as the moving joint, we need to include a header file for driving the servos and define them.

```
// Create servo object to control a servo.
#include <Servo.h>

Servo Servo_0;
Servo Servo_1;
Servo Servo_2;
Servo Servo_3;
```

After defining the function of driving the servos, we need to read the AD value of the potentiometers and convert it into the rotating angle of the servo since the servos are controlled by rotating the potentiometers.

```
//Read the values ot the potentiometers.
void ReadPot()
{
  SensVal[0] = 0;
  SensVal[1] = 0;
  SensVal[2] = 0;
  SensVal[3] = 0;

  SensVal[0] = analogRead(A3);
  SensVal[1] = analogRead(A2);
  SensVal[2] = analogRead(A1);
  SensVal[3] = analogRead(A0);
}

//The value of the potentiometer is matched to the angle value.
void Mapping0()
{
  SensVal[0] = map(SensVal[0], 0, 1023, 10, 170);
  SensVal[1] = map(SensVal[1], 0, 1023, 10, 170);
  SensVal[2] = map(SensVal[2], 0, 1023, 10, 170);
  SensVal[3] = map(SensVal[3], 0, 1023, 100, 175);
}
```

After compiling the program, we need to make Rollarm remember the steps, which is done through pressing the button.

```
//Calculate the time the button  pressed
void Button()
{
  if (digitalRead(3) == 0)
  {
    delay(10);
    if (digitalRead(3) == 0)
    {
      KeyValue = 0;
      while (!digitalRead(3))
      {
        KeyValue++;
        delay(100);
      }
    }
  }
}
```

We can tell which part of the code the Rollarm is performing by reading the value upon pressing the button. When the value is larger than 10, it means Rollarm is repeating the steps. When it is between 0 and 10, it means Rollarm is remembering. And when it is 0, it means Rollarm is being controlled by the potentiometers. The specific program is as follows:

```
//Check the button.
  static int Flag = 1;
  Button();

  //The time of pressing the button is not long then record the action.
  if ((KeyValue < 10) && (KeyValue > 0))
  {
    KeyValue = 0;
    Record();
    Mapping1();
```

```
  }
  //Long press the button and open the auto mode ,start repeating the action.
  else if (KeyValue > 10)
  {
    if (Flag == 1)
    {
      Flag = 0;
      Calculate();
    }
    Drive_init();
    delay(3000);
    for (int i = 1; i < Time; i++)
    {
      Drive_repeat(i);
      delay(500);
    }
  }
  //Did not press the button , open the manual mode.
  else
  {
    ReadPot();
    Mapping0();
```

Next, we are going to call the function to write the value of the servo rotating angle. However, it is not merely about writing the values directly; the difference between two adjacent rotating values will also be written into the servos. Here we take a servo program for example.

```
//The first axis.
  if (Dif0[n] > 0)
  {
    for (int j = Joint0[n - 1]; j <= Joint0[n]; j++)
    {
      Servo_0.write(j);
      delay(10);
    }
  }
  else
  {
    for (int j = Joint0[n - 1]; j >= Joint0[n]; j--)
    {
      Servo_0.write(j);
      delay(10);
    }
  }
```

# 6.2 PC Control (by Labview)

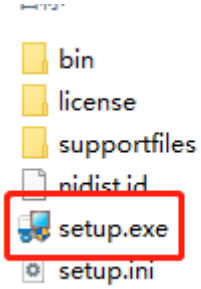
## 6.2.1 Installing Labview Software

For this kit, we use the Labview software for control on PC. If you have other better options, welcome to share by post under FORUM on our website www.sunfounder.com.

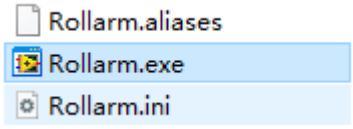
Download the Labview package in the link below:

https://s3.amazonaws.com/sunfounder/Arduino/Labview.zip

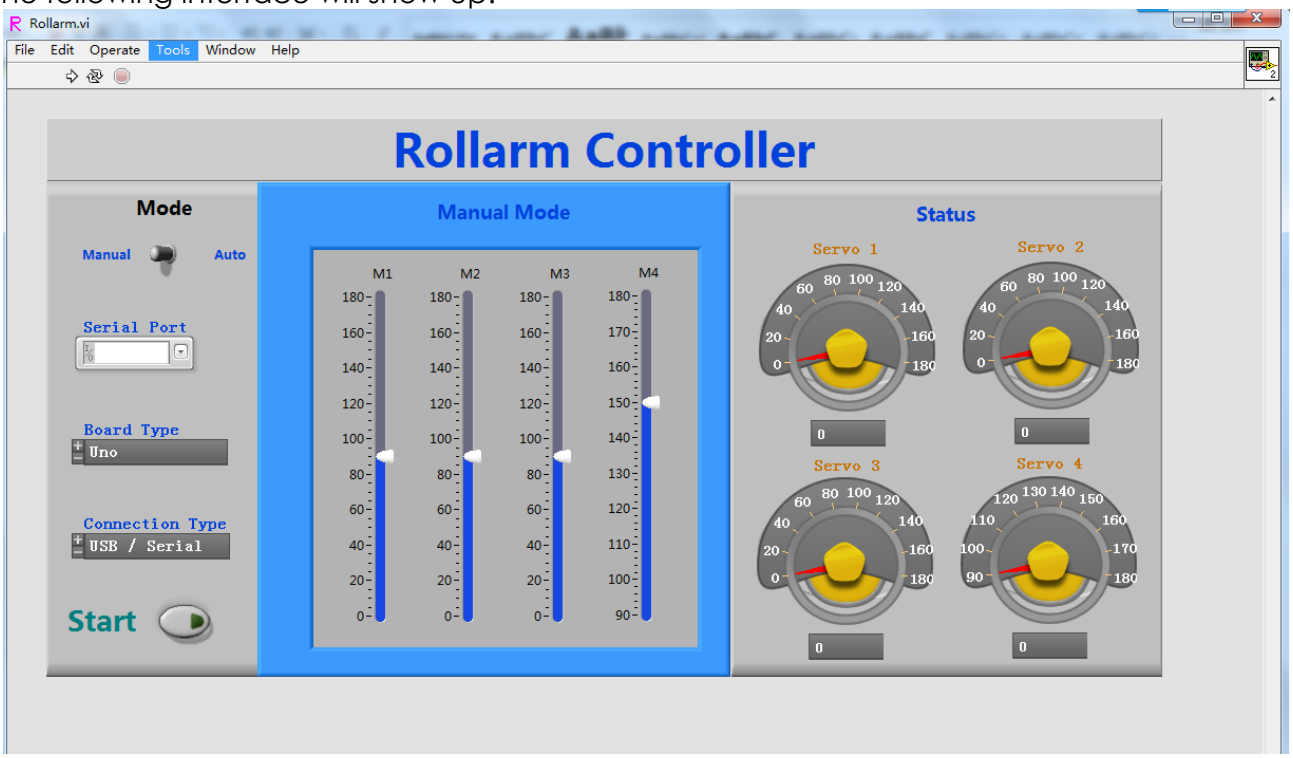
After downloading, unzip and open it. If you haven't installed the Labview Runtime, you can get into the **Labview\Rollarm Project\Rollarm Installer** folder, install the setup file:




After the installation is done, in Start Menu, find Rollarm to open the Rollarm software. Or, enter the installation directory we used just now, and double click Rollarm.exe to open it. The defaulted installation directory is: C:\Program Files (x86)\Rollarm.




The following interface will show up.

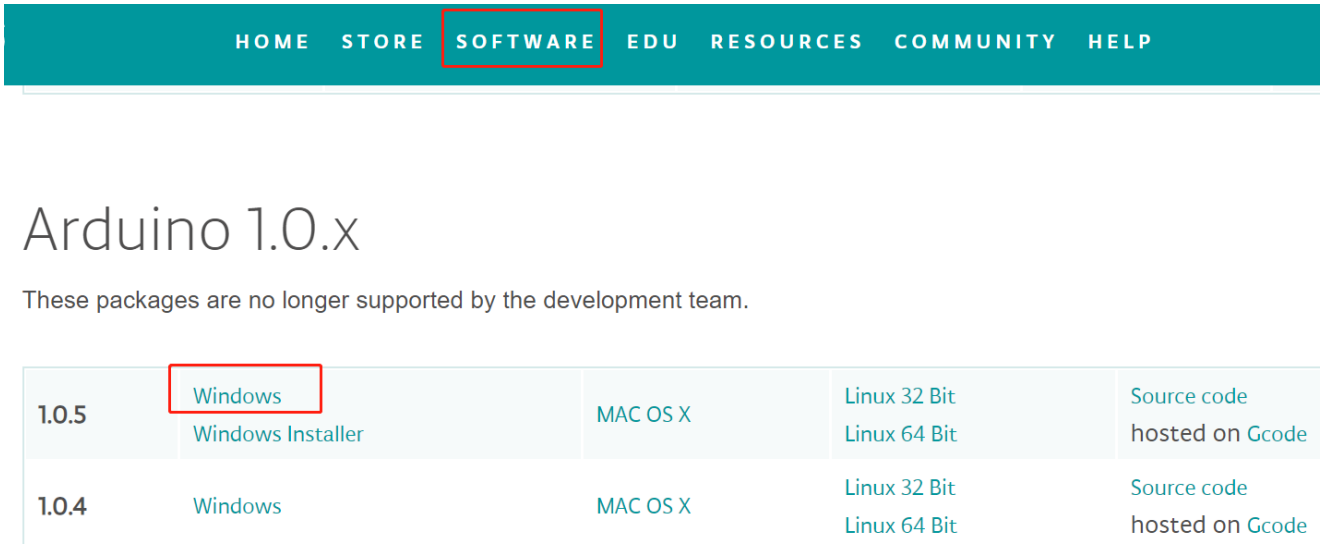


## 6.2.2 Upload the Code

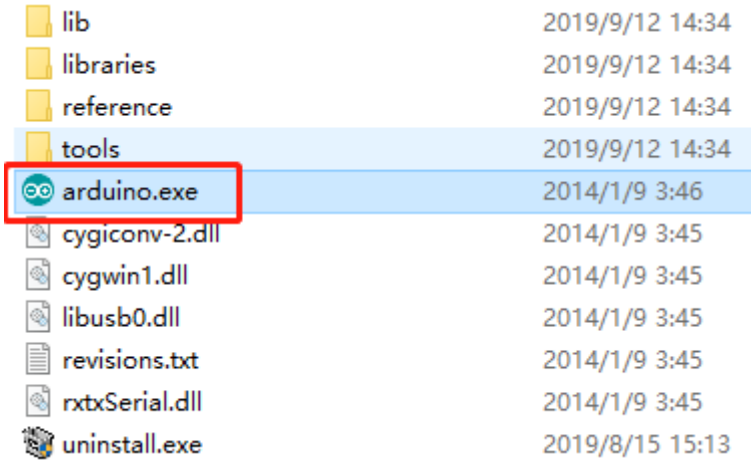
Before using the Rollarm Labview software, flash the control codes into the Rollarm robot, and the steps are as follows.

**Step 1**: In order to avoid the incompatibility, please download Arduino IDE 1.0.5 on Arduino official website: https://www.arduino.cc/en/Main/OldSoftwareReleases#previous

You are suggested to download zip version because zip version does not need installation and you can use it directly.



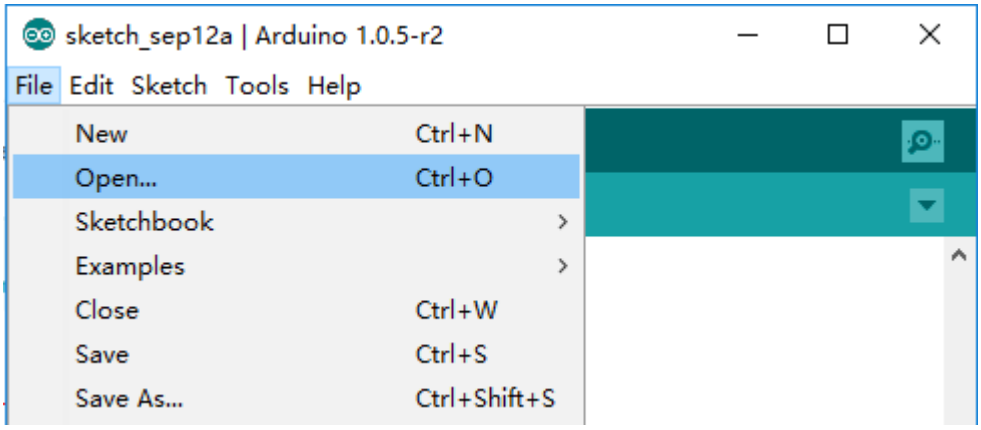

**Step 2:** After downloading and unzipping them, you need to double click the arduino.exe to open it.



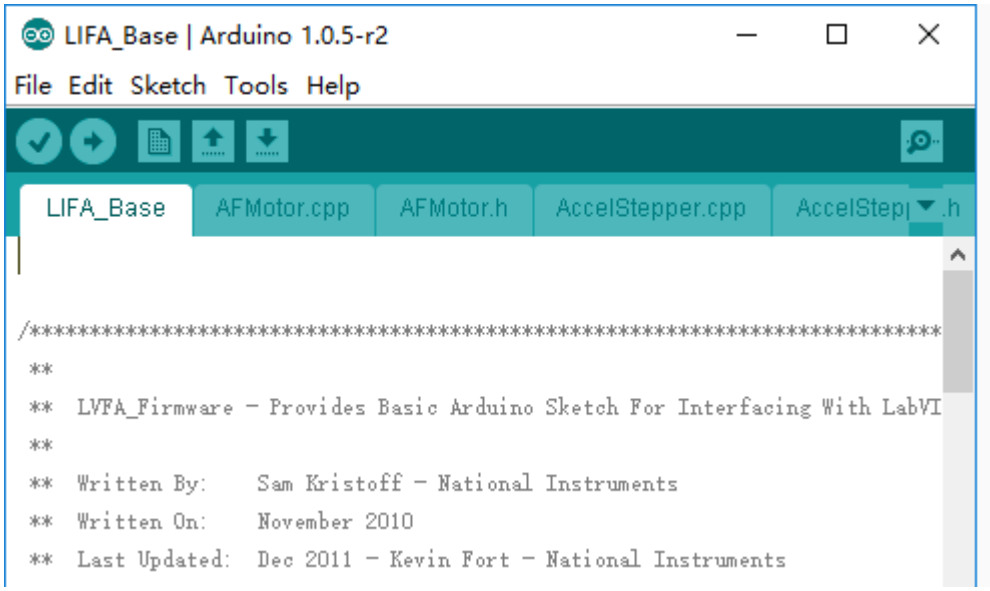

**Step 3:** Click File- >Open, and you can find the **LIFA_Base.ino on the** path

DIY_Control_Robot_Arm_kit_for_Arduino-Rollarm.1\Arduino Code\LIFA_Base

And click to open.




**Step 4:** Choose the proper Board and Port, and upload the codes to the control board.



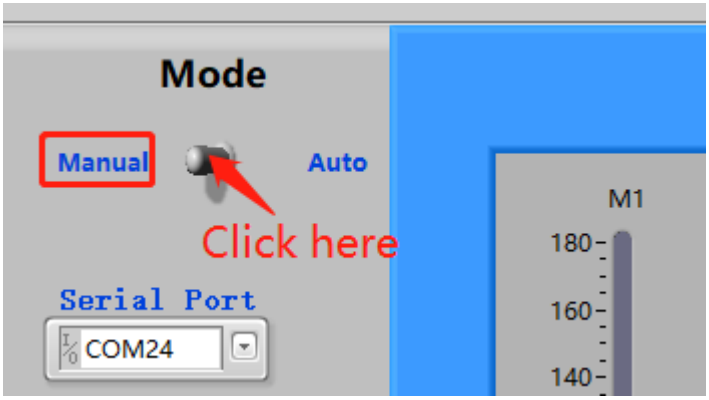

DO NOT unplug the USB cable at the moment.

## 6.2.3 Using the Software

Back to the Rollarm Labview software, which includes two parts: Manual Mode and Automatic Mode.

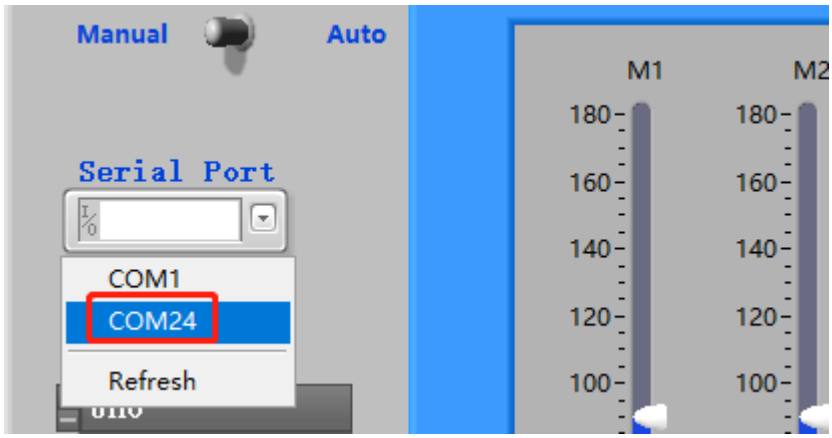
### 1) Manual Mode

**Step1:** See the interface of manual control below. After the Labview is installed and run, this mode is enabled by default.

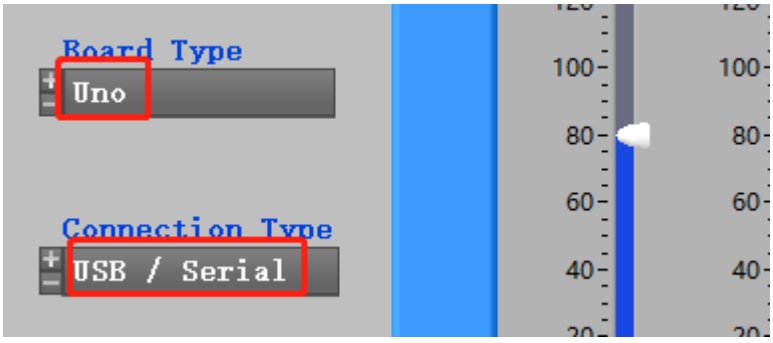



**Step2:** Click the inverted triangle icon for **Serial Port**, select the port according to you COM port. Here is COM24, which varies for different computers.

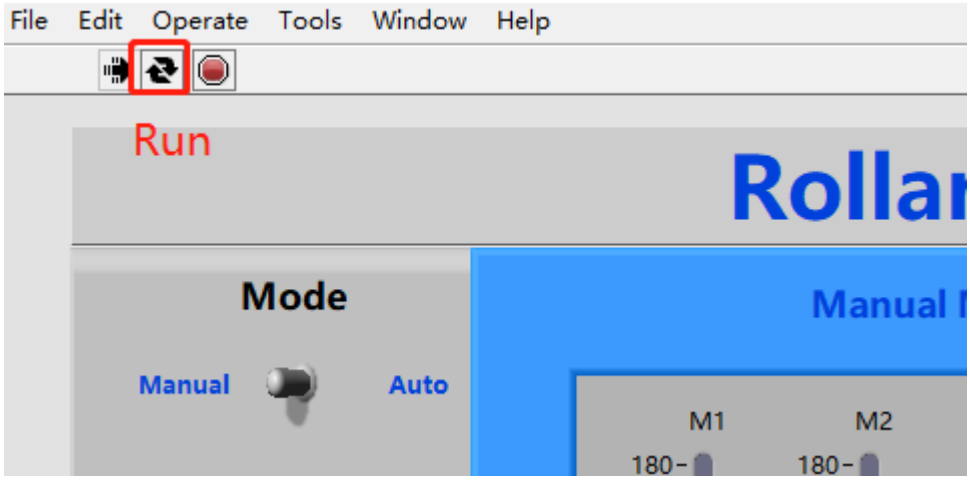
Note: If you can only see COM1,to solve the problem, just replug the USB cable. Then start from sketch upload again.



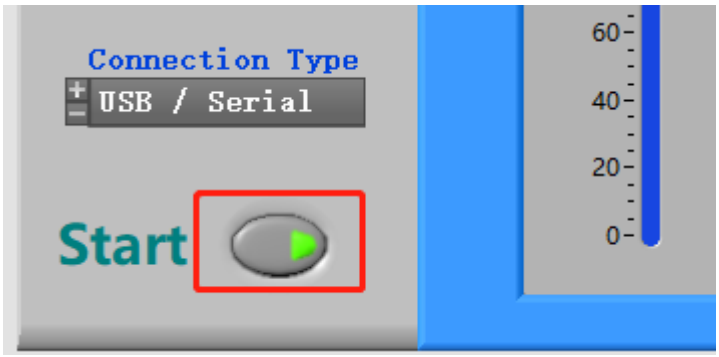

**Step 3:** Select the **Board Type (Uno)**and **Connection Type(USB/Serial)**.



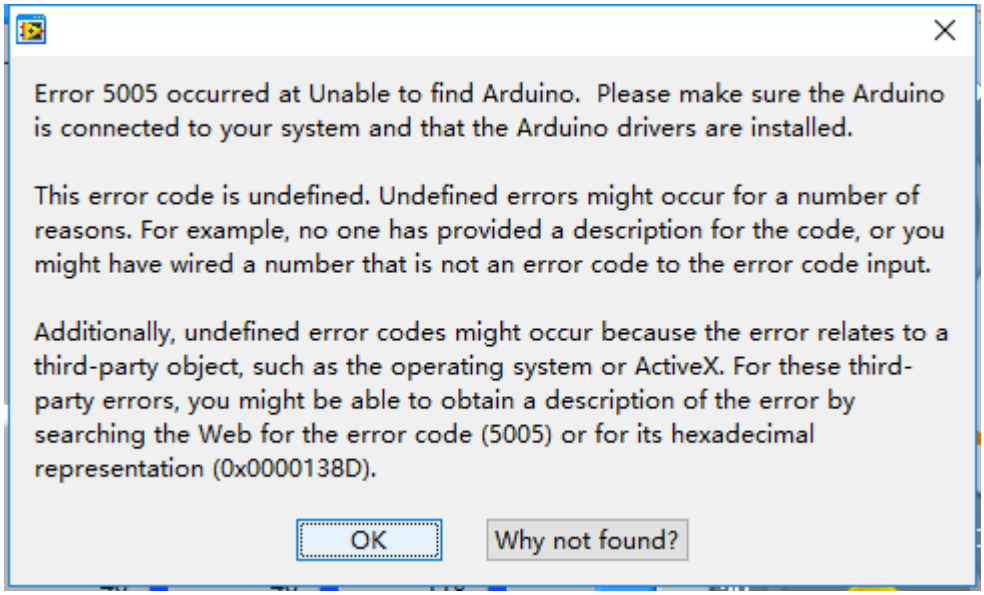
**Step 4:** There are **three** small icons at the top left. Click the middle on to run the software.



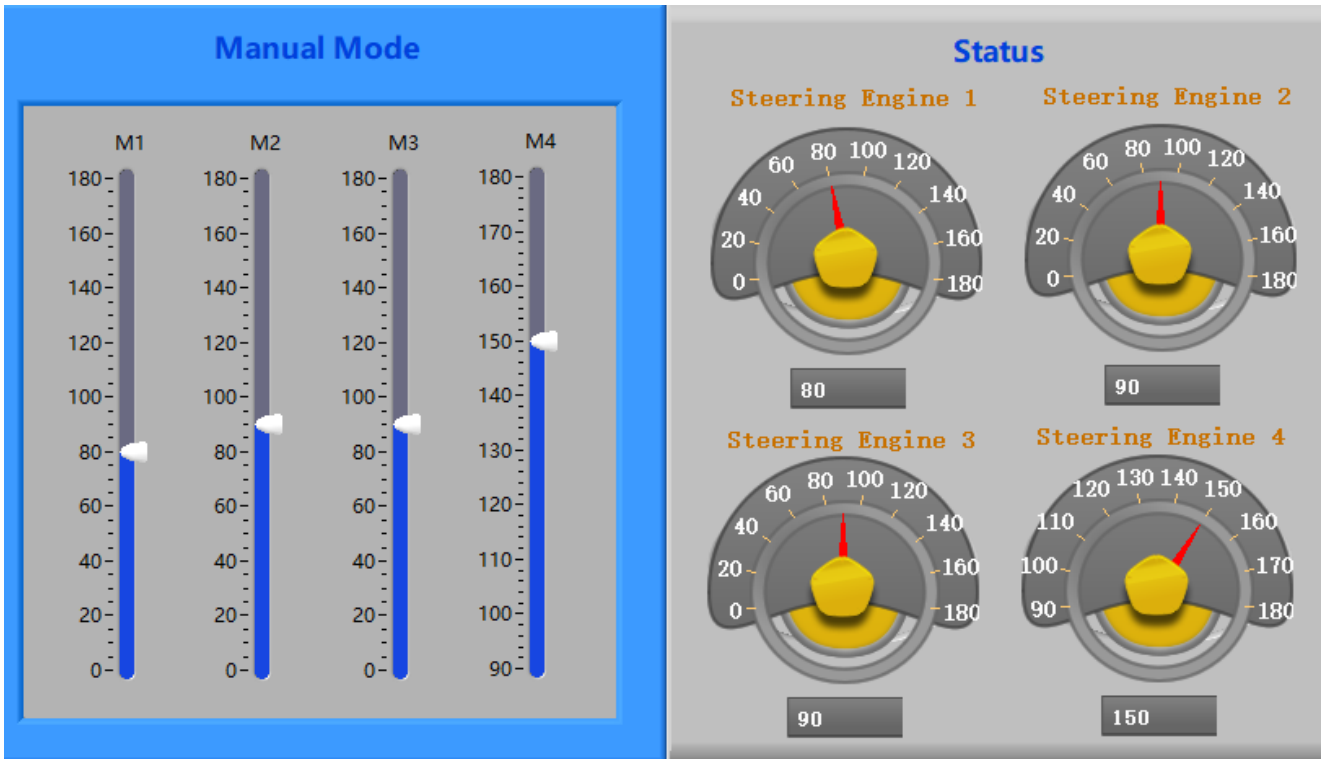

**Step5:** Click **Start**, and the button will change from dark to light **green.**

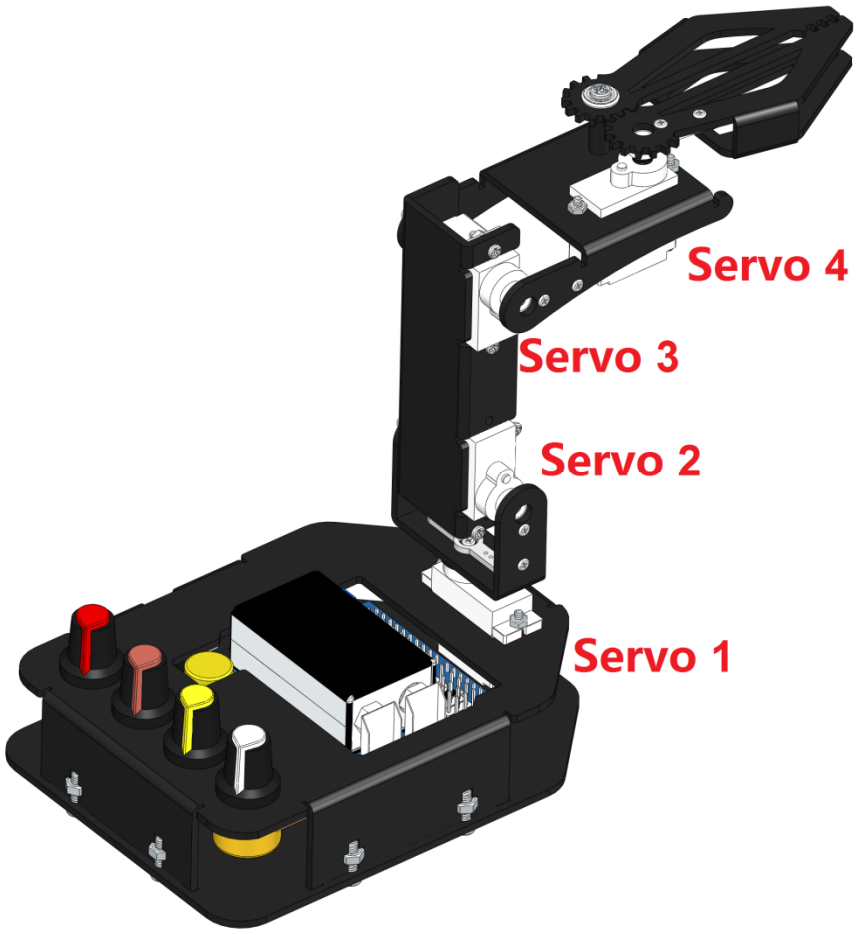



Note: Sometimes you can see the mistakes like 5005 or 5002 that are as results of the software recognition failure of Arduino control board. Now, please click OK. Then there is a quick quiver state in Rollarm robot to return to the setting position. After that, you can continue to do your next step.



**Step 6: M1-M4 correspond to Servo1-Servo4,** you can move the slider control the 4 servo on the Rollarm.



## 2) Automatic Mode

You can also switch to **Auto Mode**. Fill the value of the rotating angle of the servos into the table under **Auto Mode** one by one. After filling the figures, click the **Start** button, then Rollarm will then perform as you just set.

**M1-M4:** Servo1-Servo4.

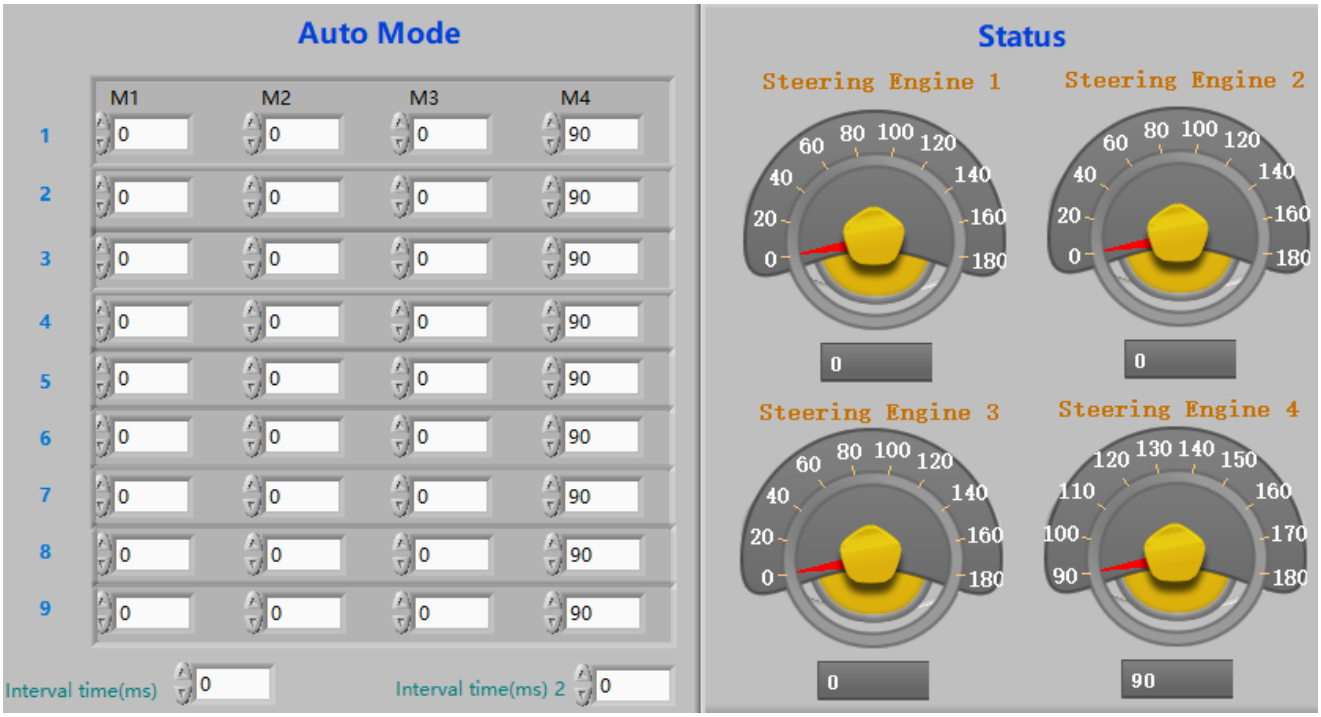
**1-9:** 9 groups of rotating angle.

**Interval times(ms):** The interval times between two groups, such as interval times between M4 in row 1 and M1 in row 2.

**Interval times(ms) 2:** The interval time between two rotating angles within a group.

6.2.4 Note: the range of the data for Mode 4 is 90~180. Otherwise, it will be damaged due to stalling.

6.2.5




6.2.6

# FAQ

1) About the assembly:

Q1: After assembly and program download, the Rollarm's four axes are in wired position, some may be out of control. What should I do?

A: Remember to power on and calibrate each servo before assembly.

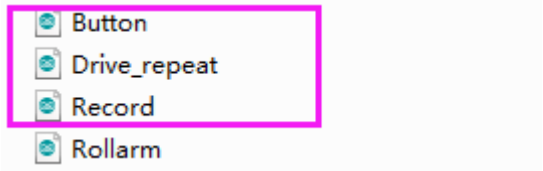
Q2: When I mount the rocker arm, the acrylic plate cracks.

A: When you fasten the rocker arm with the screws, do not over tighten them forcefully.

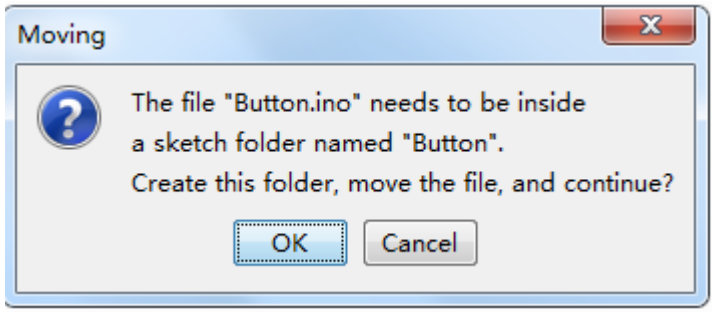
2) About the Arduino code control:

Q1: When I open a program, it prompts me that a new folder should be created. After I click **Yes** and a new folder is created, the main program reports an error when I want to open the main program. What's going wrong?

A1: DO NOT open these subprograms under *Arduino Code**Rollarm* separately:

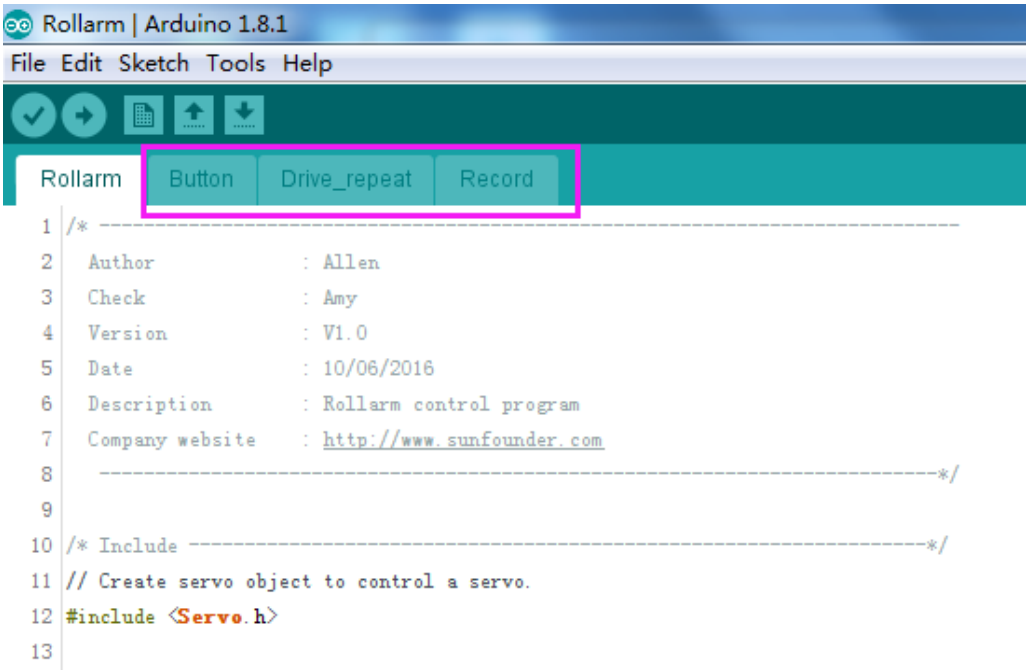



If you open the subprograms separately, a dialog box will pop up like this:




If a new folder has been created for the subprogram, please cut the subprogram file to the original directory *Arduino Code* *Rollarm*. Reopen the main program:

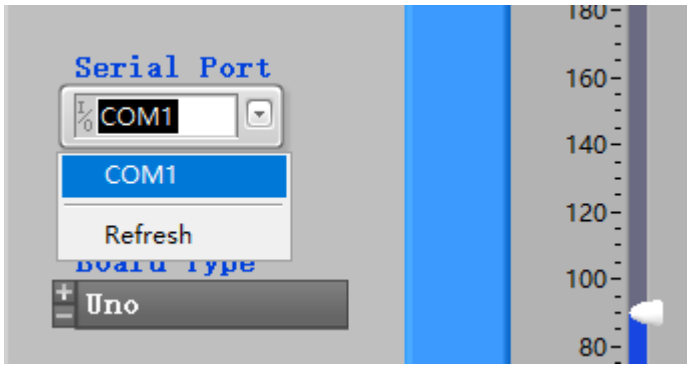
Then you can see the subprograms have been opened too:




3) About the Labview software control:

Q1: After powering on the Rollarm, why do the servos shake a little when there's no movement at all?

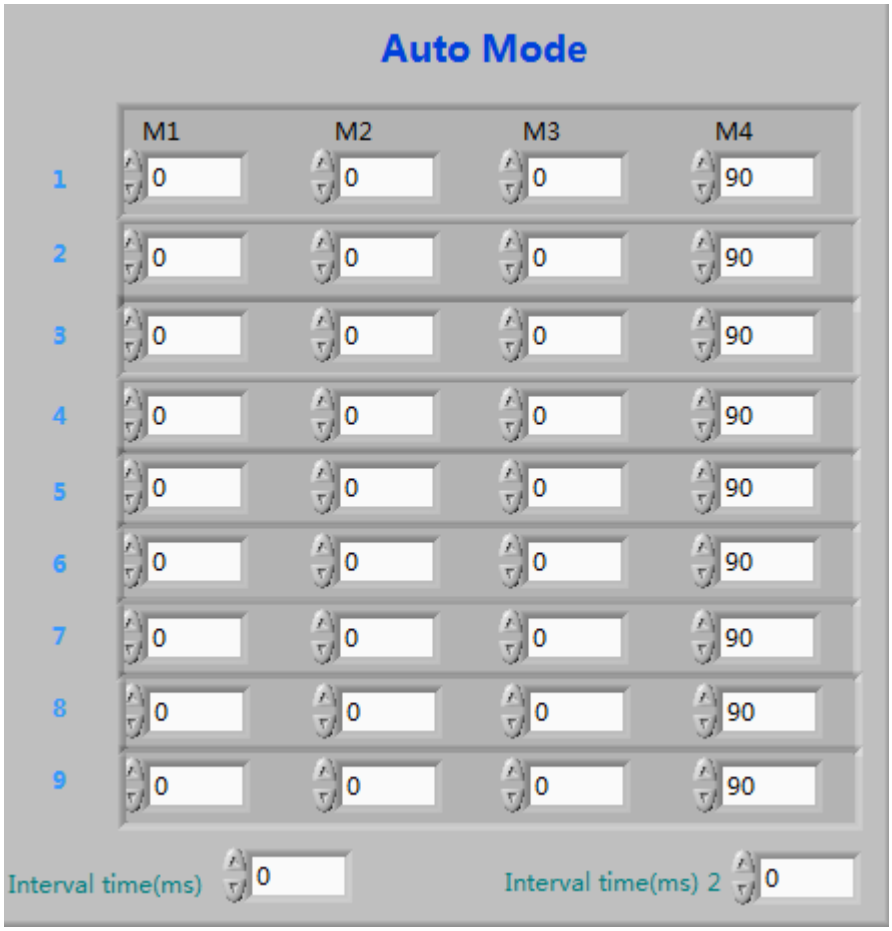
A: There may be something wrong with the Serial Port. For instance, the following condition may appear:




Turn off the Rollarm, power it on again, and reconnect the serial port to try.

Q2: The Rollarm is in a strange position when I click **Start** and it's in the automatic mode. Anything wrong?

A: Here no value is filled in the table yet. The first three axes are in 0°, and the last one is in 90°. You need to fill the correct value of the rotating angle first, and click **Start** to run.




Before clicking Start, you need to fill in the rotating angle for each axis in different steps, and the interval time between steps. If you don't know the exact angle, you can shift to the manual mode and note down the angle values for each step, and then shift back to fill in. When all the steps above are done, you can click Start to let Rollarm perform the automatic control.

## Copyright Notice