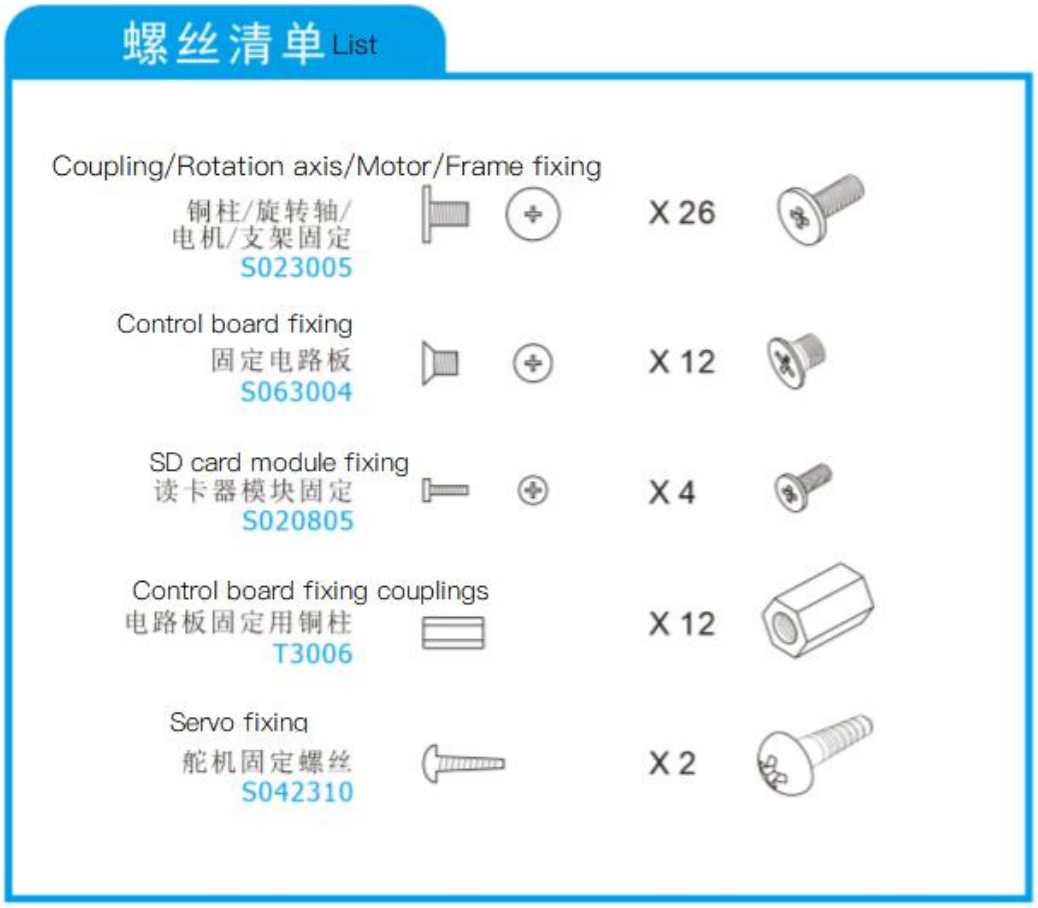
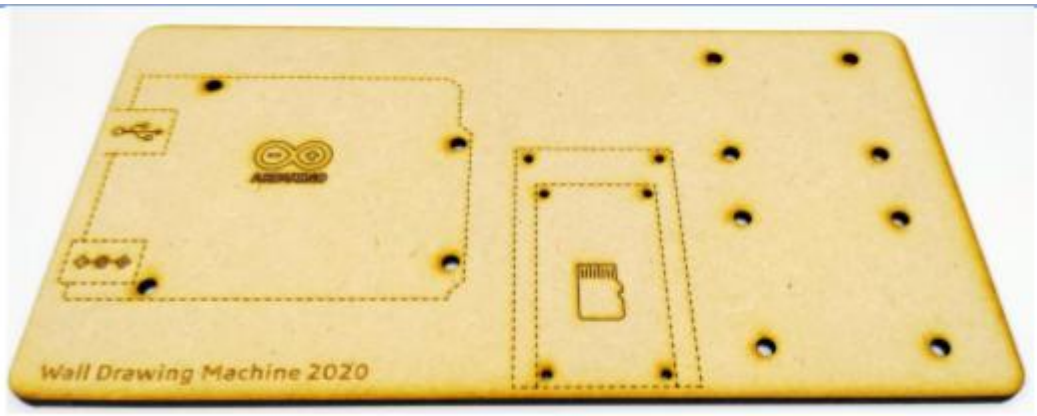
Welcome
Wall Drawing Machine 2020

Installation and debugging instructions

1. Installation

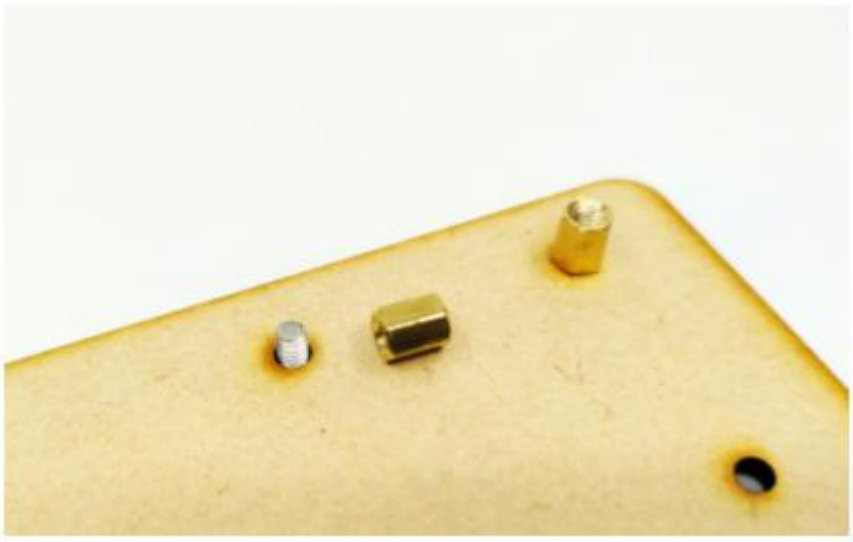


There are many types of screws in the accessory bag, please make sure to distinguish clearly before starting construction.

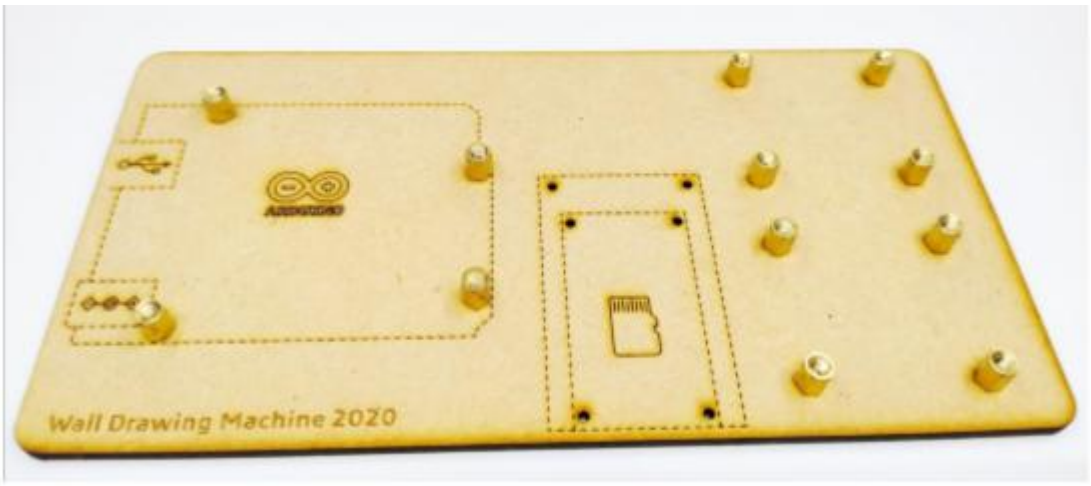


Start with the base

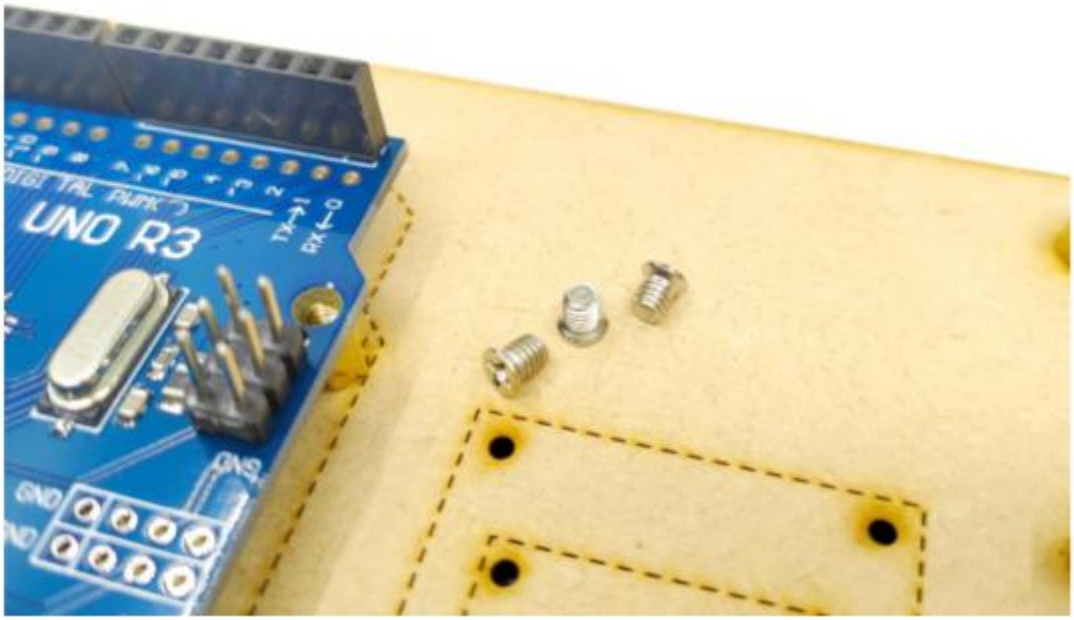
Find 12pcs big cap screws and 12pcs cpuplings



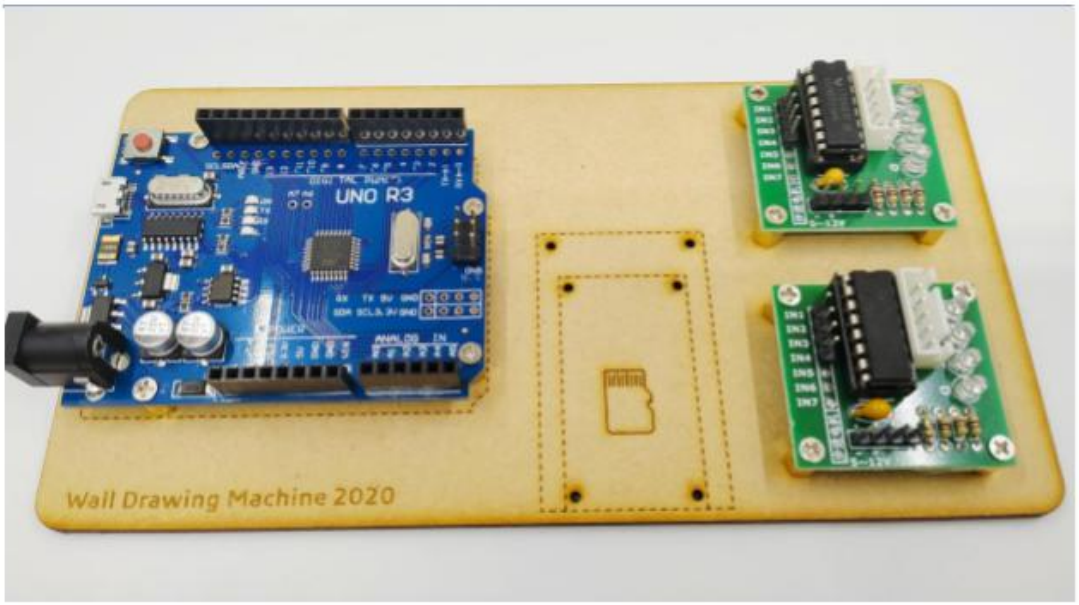
The big cap screws are screwed into the fixed couplings from the back



Fix all couplings

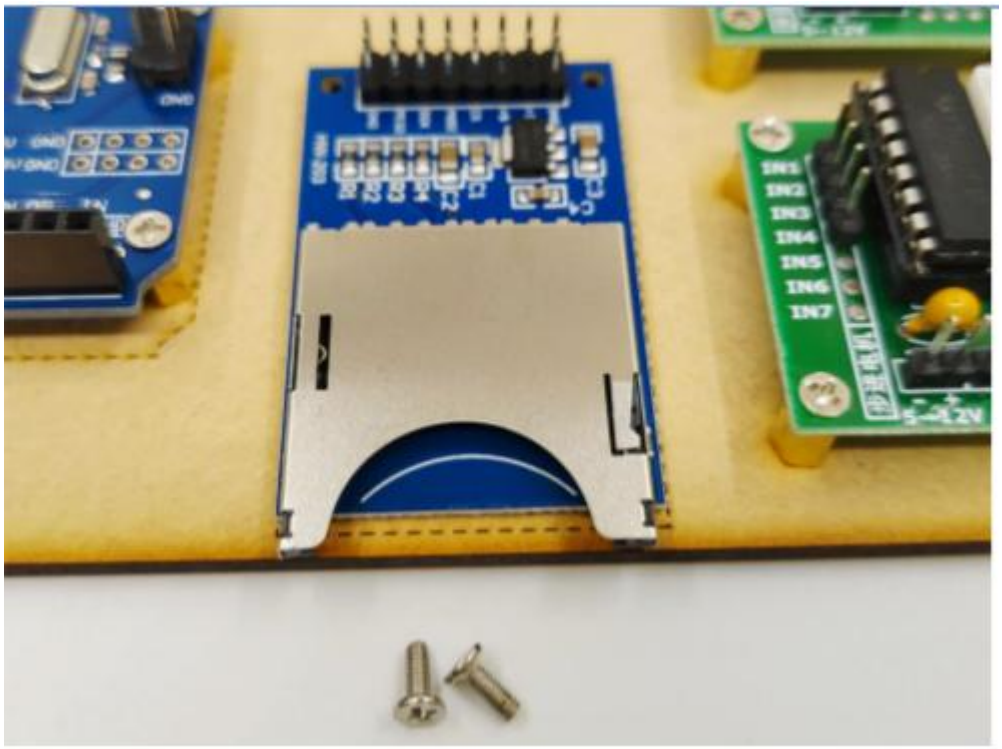


Use control board screws to fix the arduino uno board and stepper motor module on the couplings

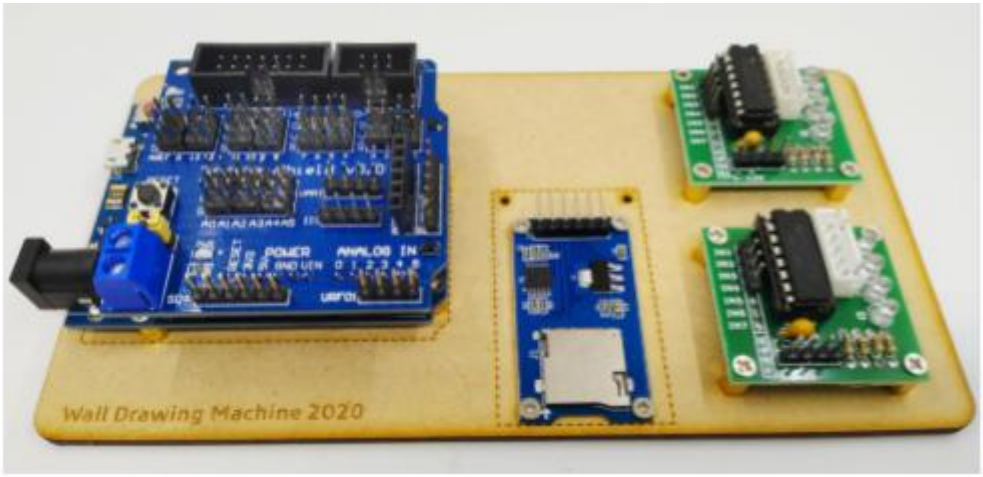


The wiring diagram is below, no wiring is needed for now.

Fix the SD/TF card reader directly on the base with the smallest screw. Generally, it is enough to fix it tightly with 2 screws

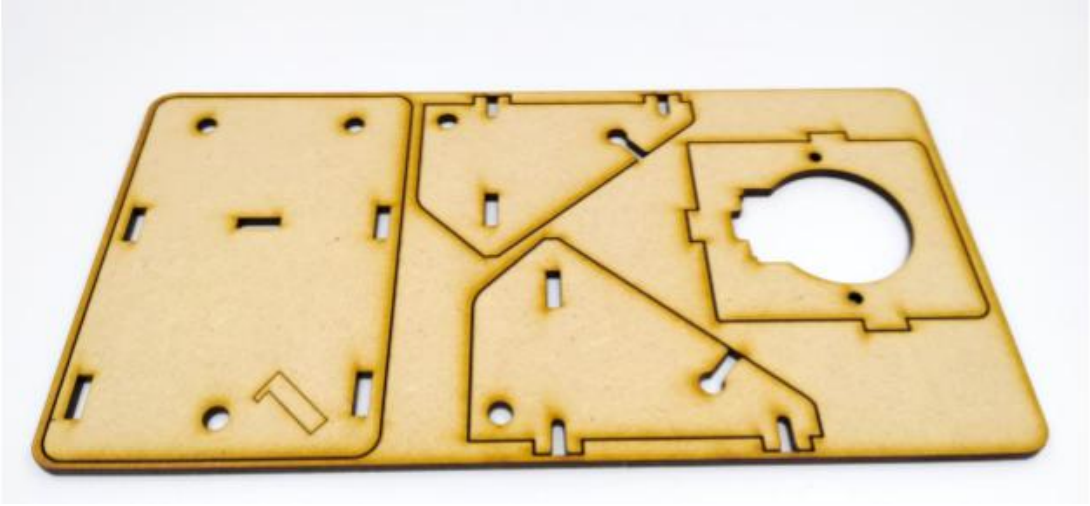


The SD card reader is 2 screws.

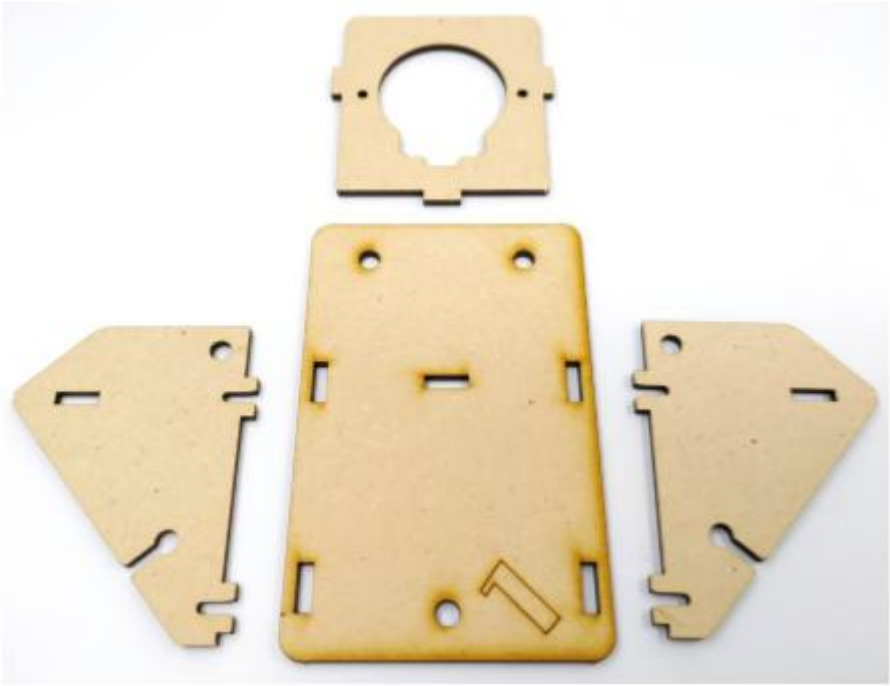


After installation (the circuit wiring diagram is at the back 3.)

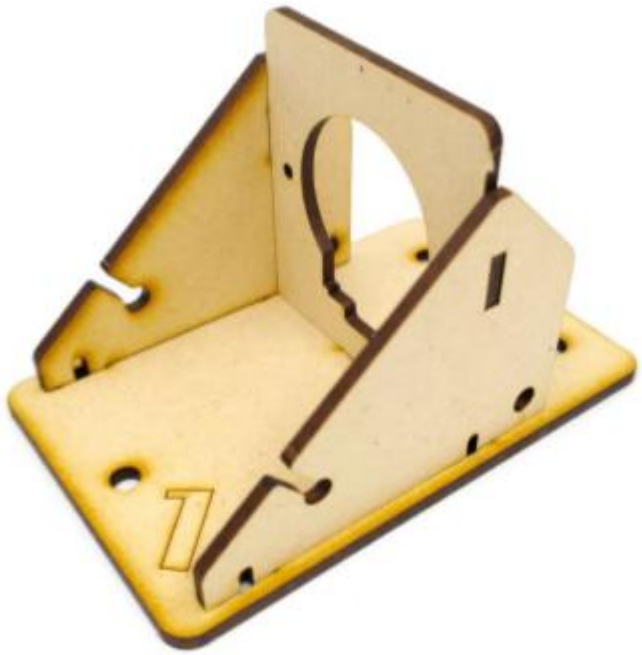
Motor bracket

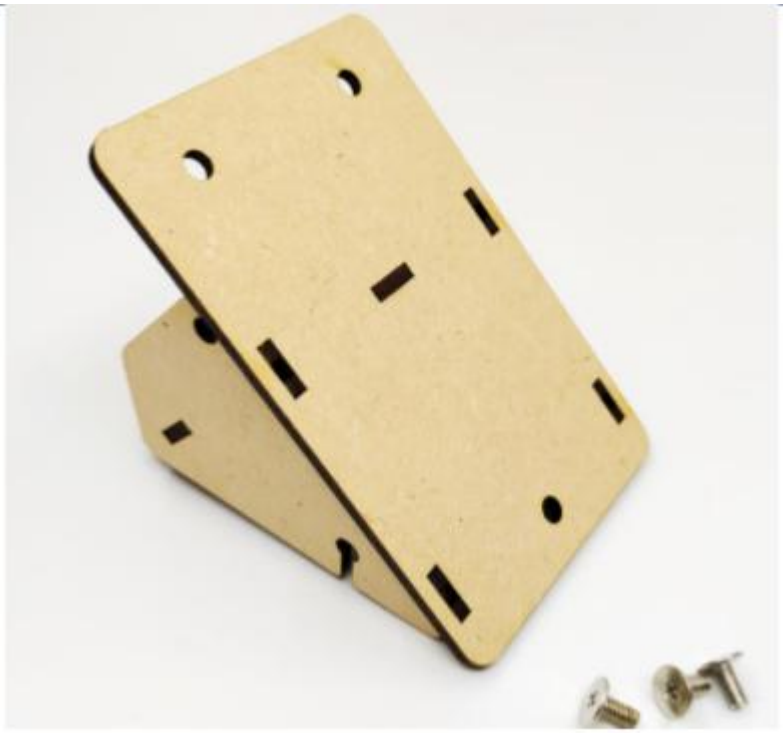


Installation of motor bracket



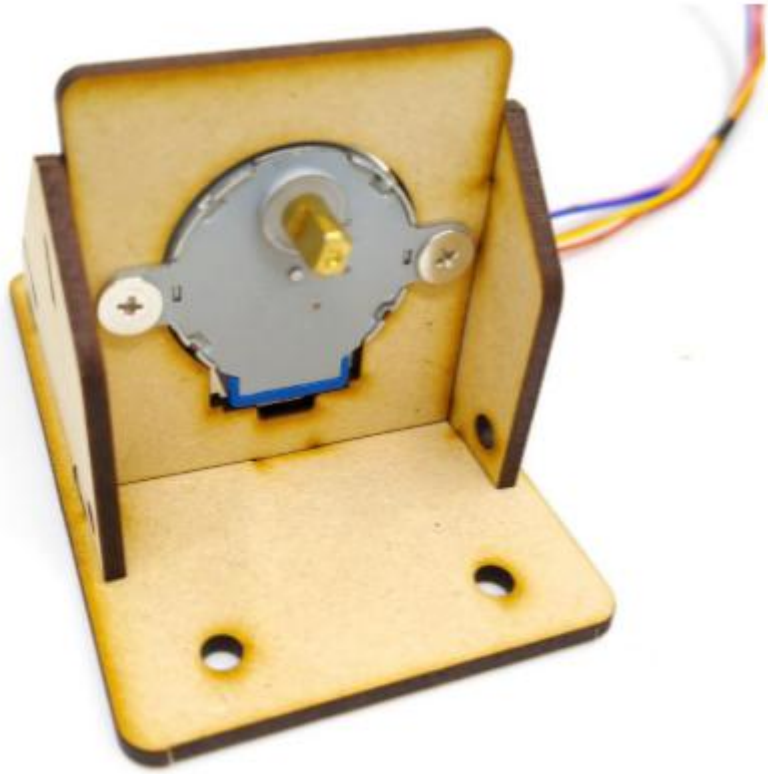
Buckle the parts first


1

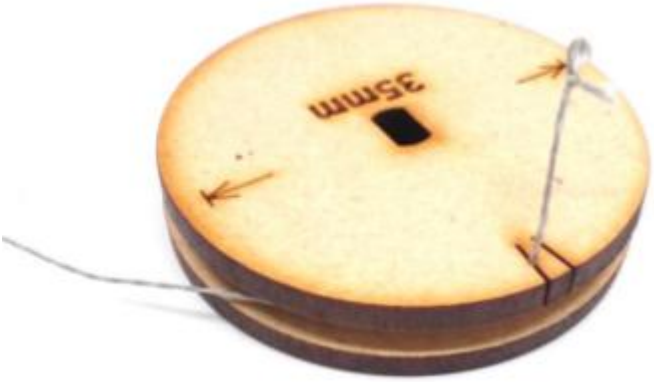


Big cap screws fix the vertical plate from behind

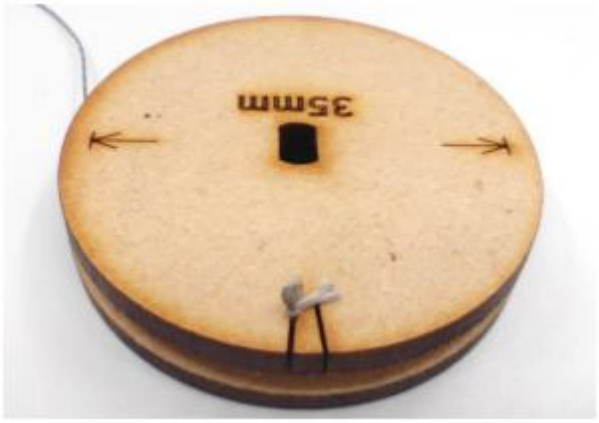
Install the motor



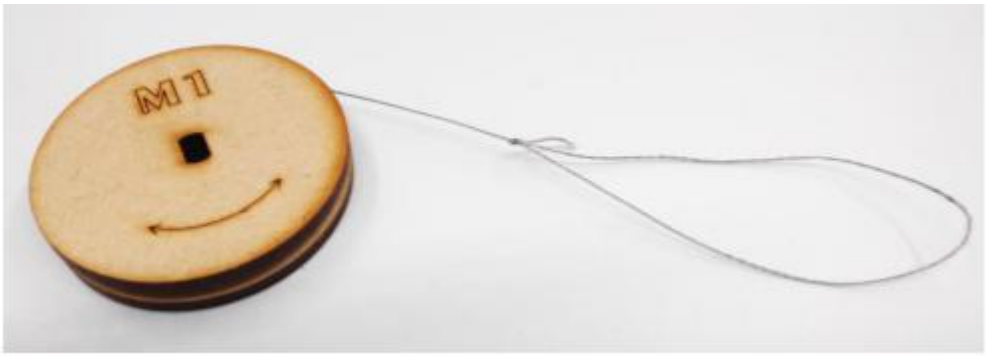
First tie a section of the cable with a buckle



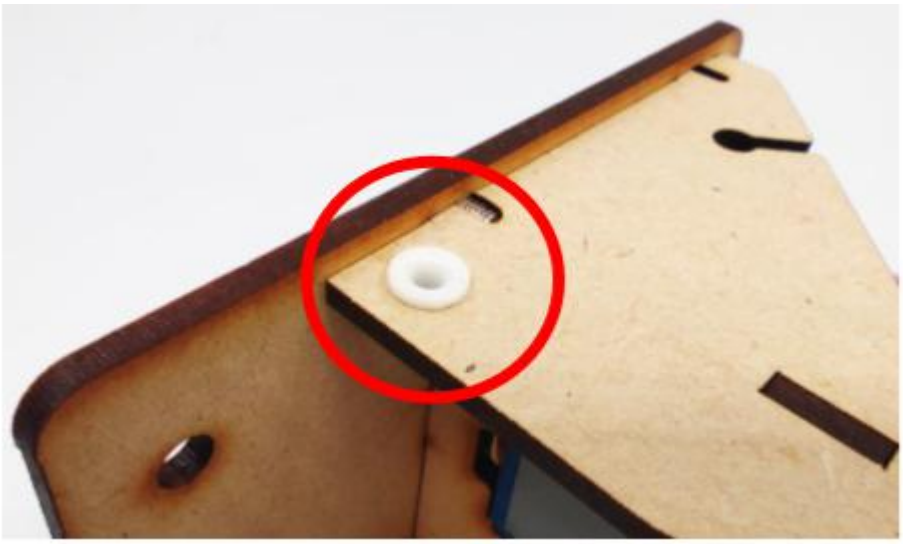
Pull the cable into the gap on the back of the spool



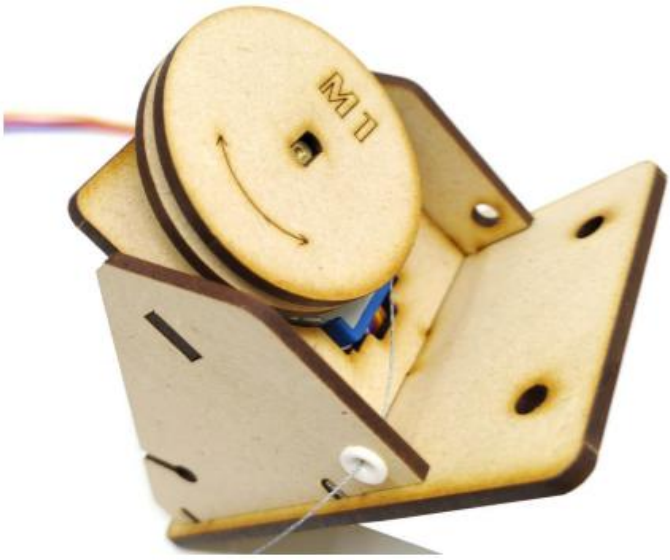
Just wind the cable on the spool. The left spool is clockwise and the right spool is wound counterclockwise.



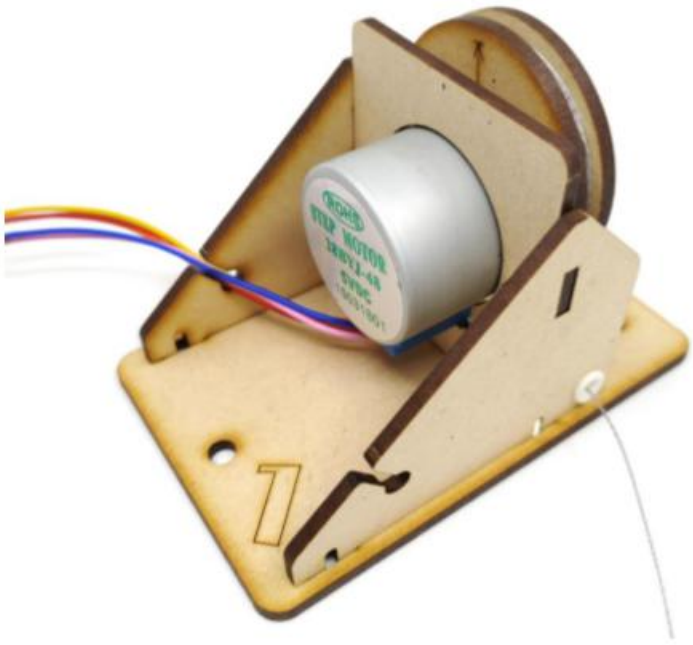
On the other end of the draw rope, tie a larger rope sleeve to set the pen

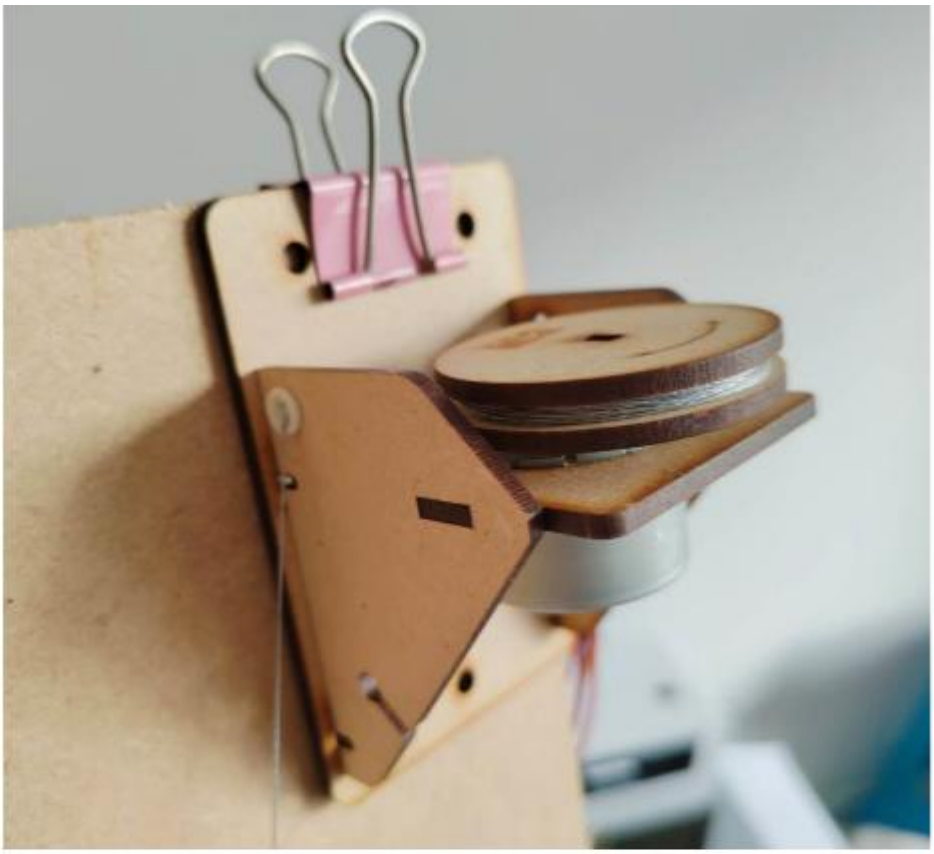


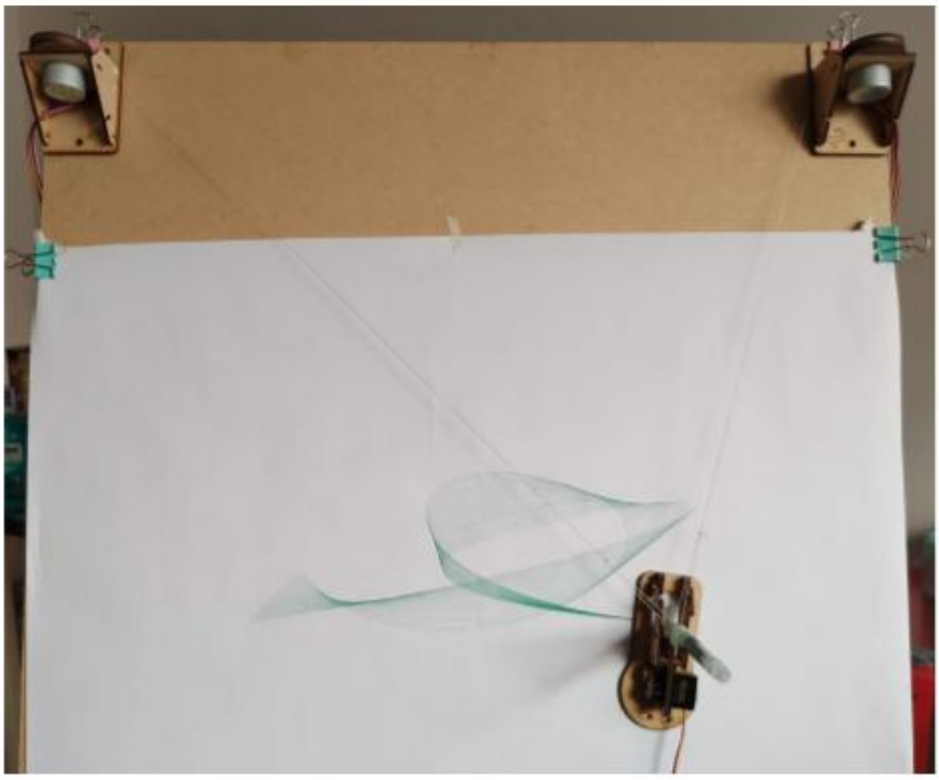
The wire loop (which can reduce wire friction) is inserted into the hole of the vertical plate and installed on one side of the motor bracket



The motor bracket is installed on both ends of the drawing board or the wall, and the level is as consistent as possible. In the program, the distance of point AB needs to be modified, which is the distance between the white wire holes between the two brackets (not the distance between the two spools), and the program needs to be modified after measuring the installation distance (see the principle and parameter explanation section below for details).

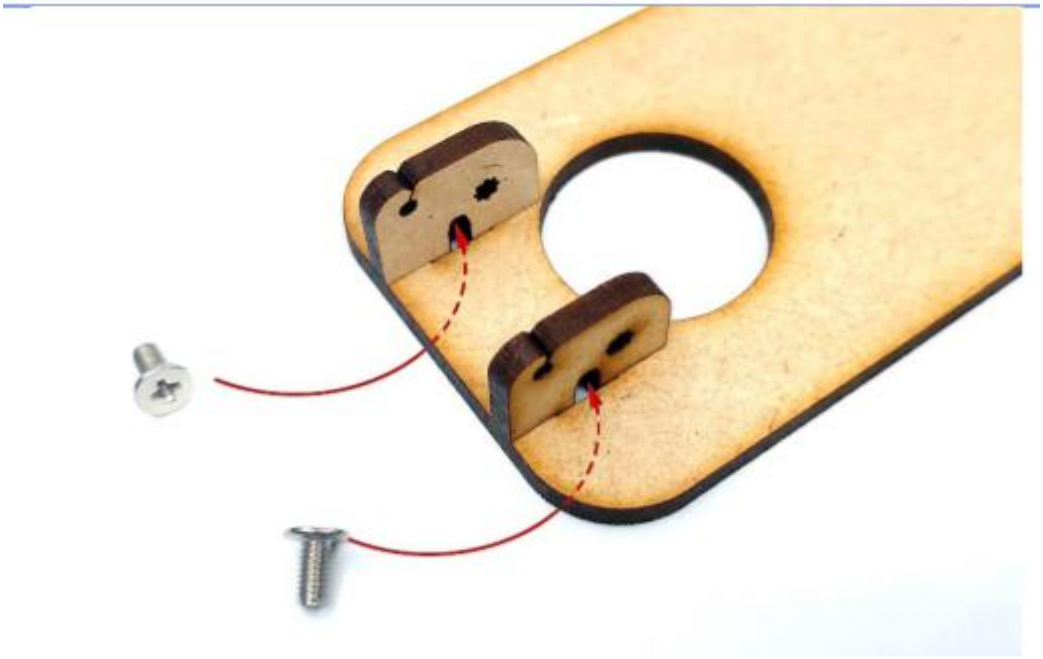






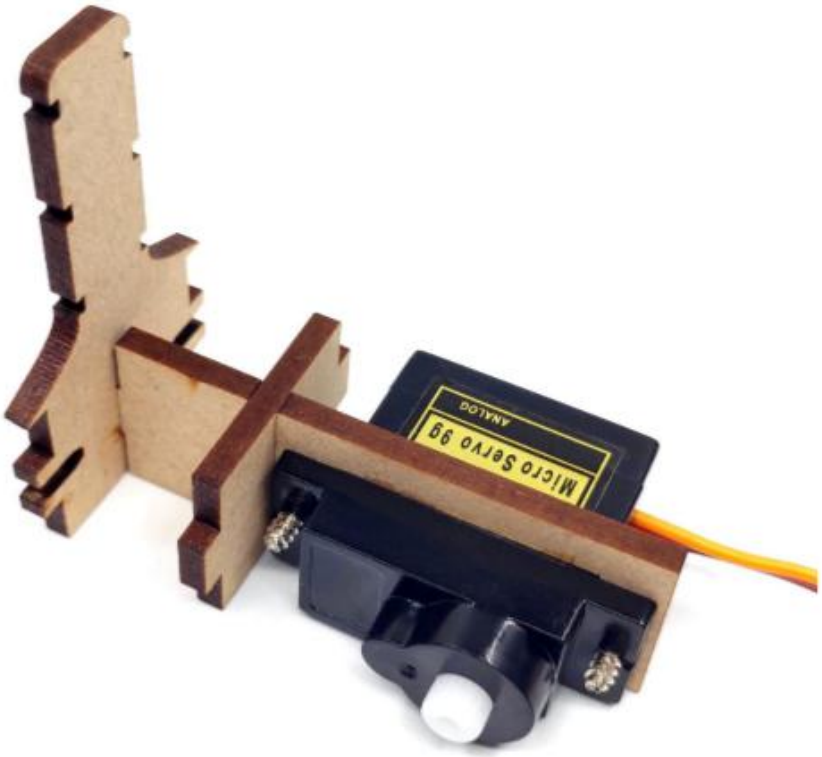
Typical bracket installation method. The bracket can be fixed with screw holes, or it can be fixed by pasting.

Assembly of the pen holder

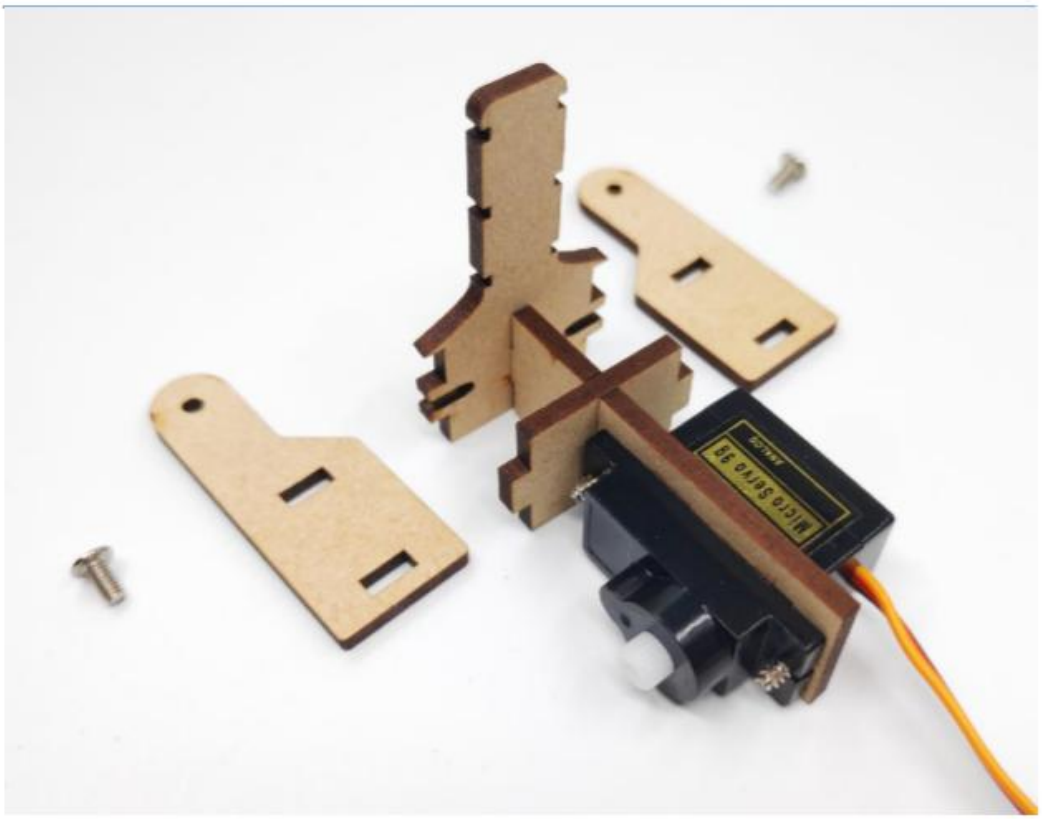


First install the base, 2 big cap screws, screw in from the back, no need to over tighten.

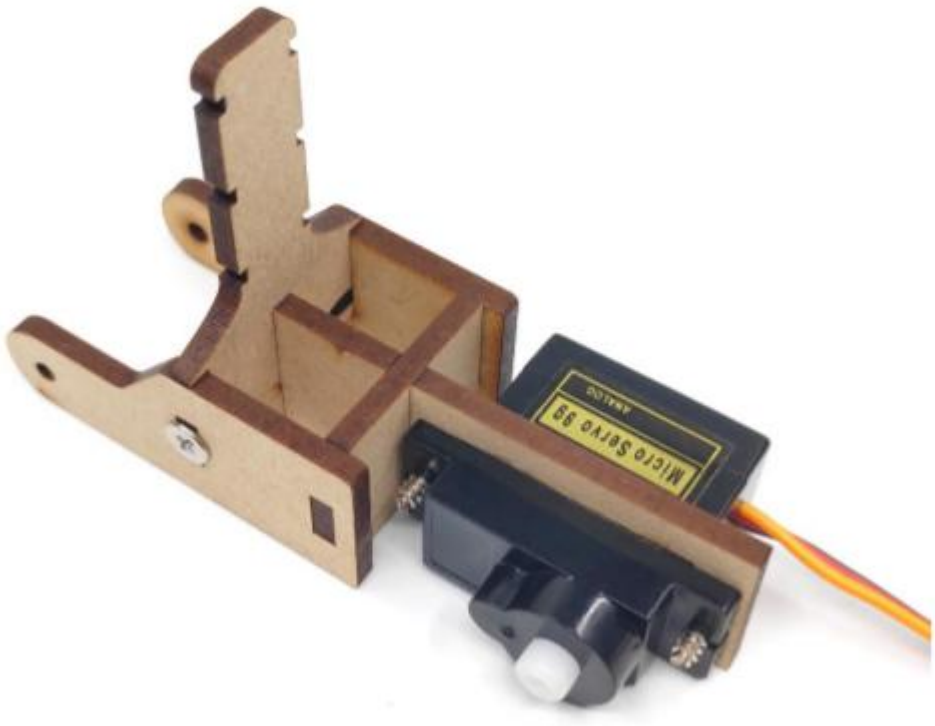
Install the servo bracket first.

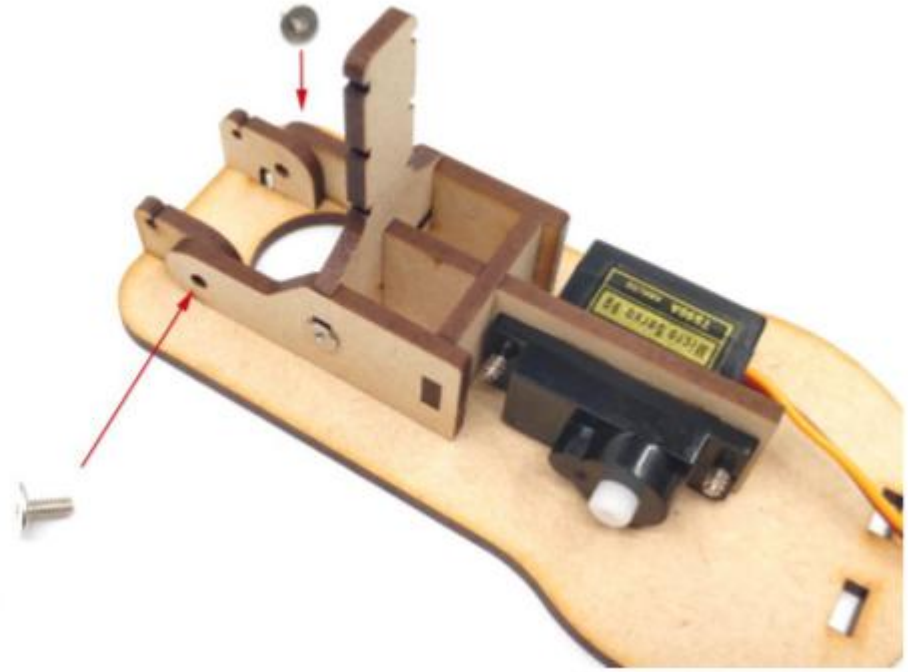


Compatible with various types of 9g servos regardless of left or right. Please ensure that the center of gravity is the most centered and the operation is more stable. (Here is equipped with 4pcs 2 kinds of screws of similar size, Please assemble with suitable screws)

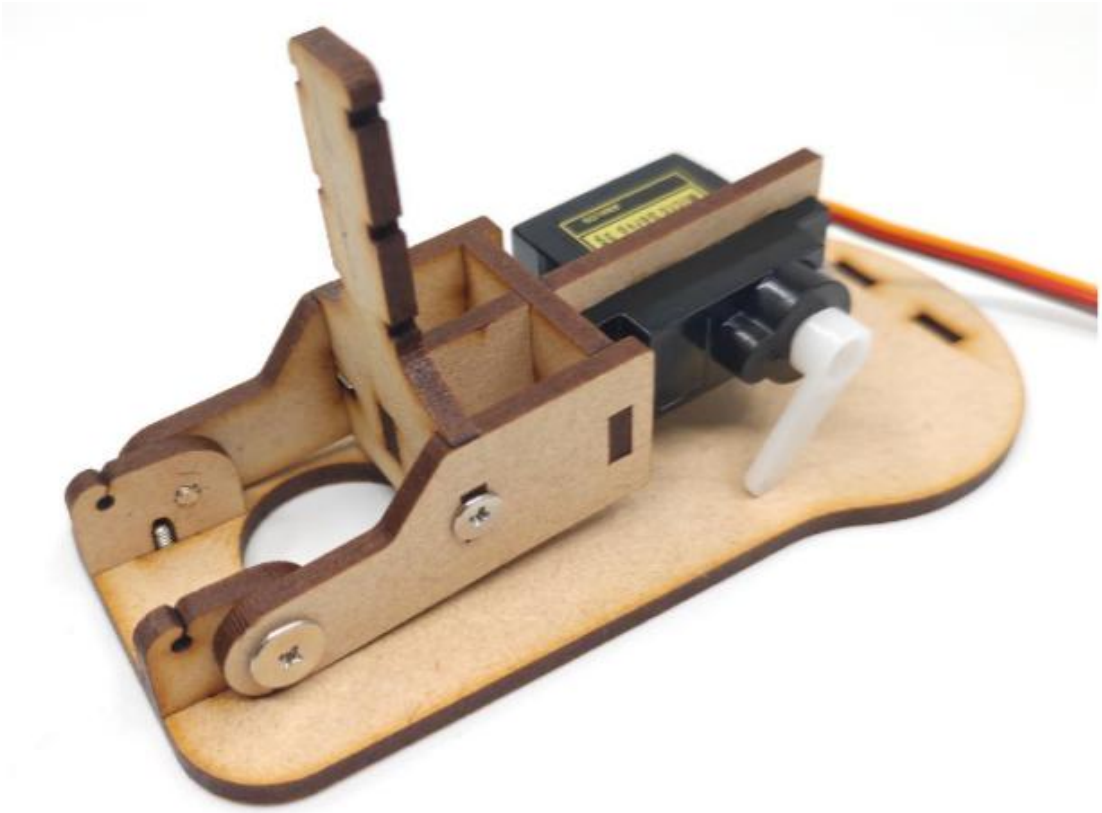


The left and right side panels need big cap screws to fix

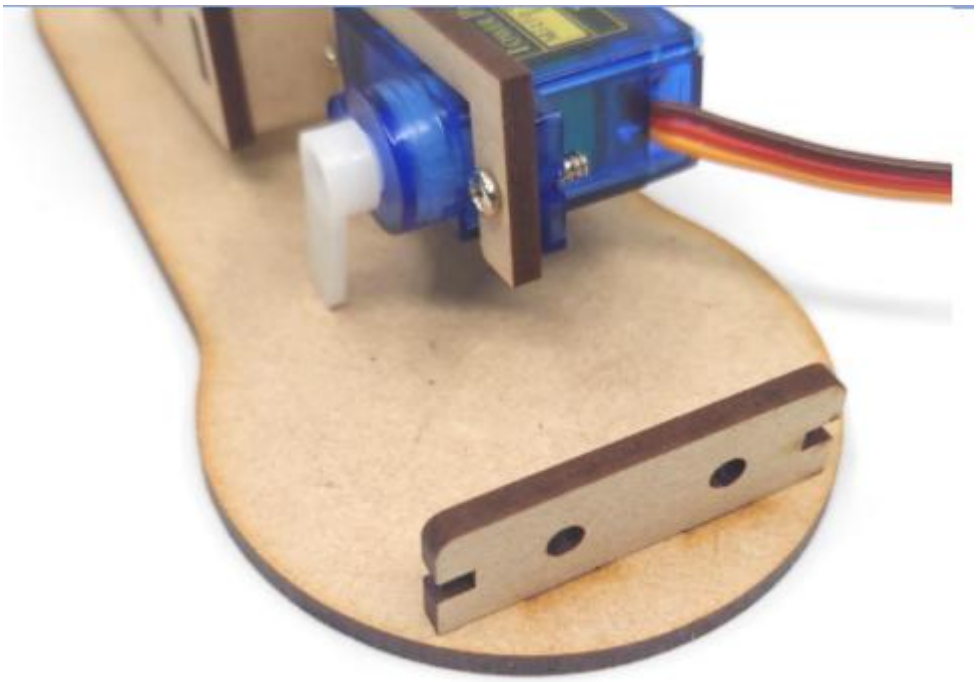




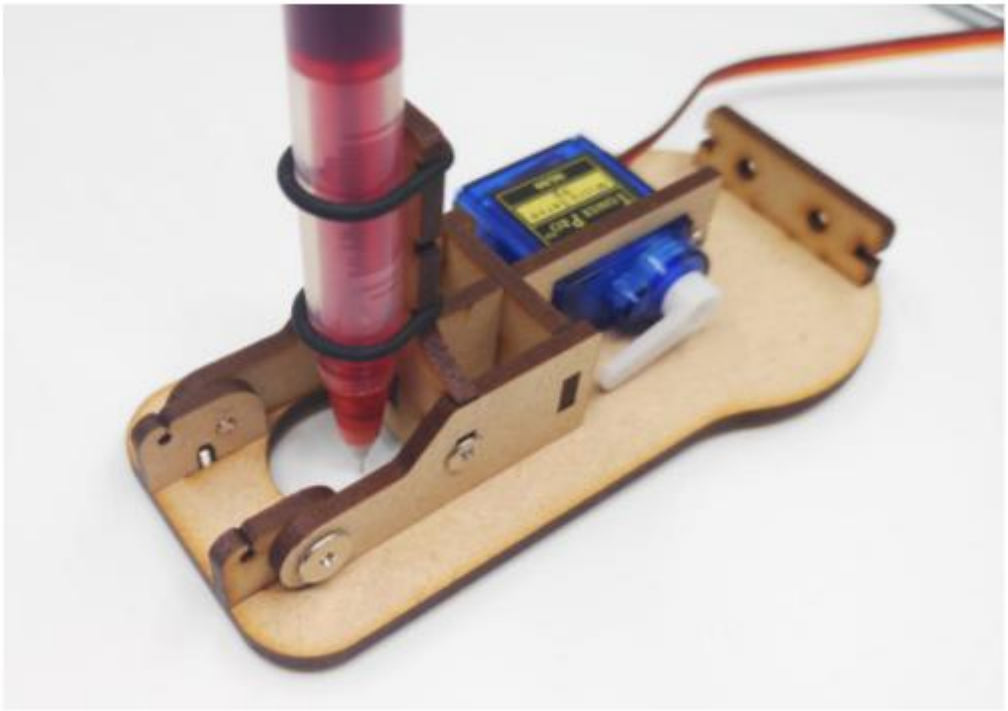
The rotating shaft needs big cap screws, which cannot be tightened, and there must be room for movement so that the pen holder can rotate freely.

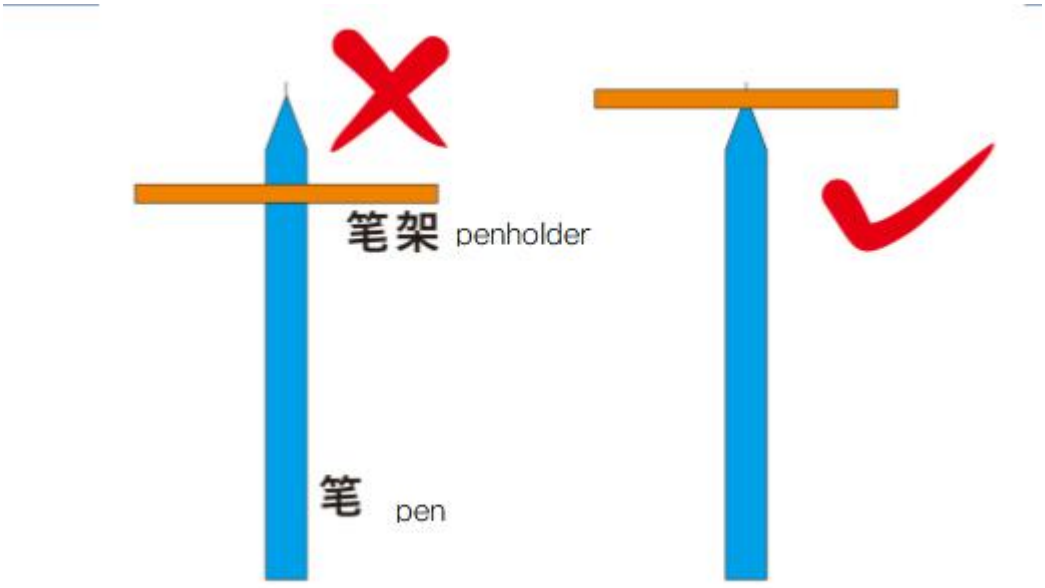


For testing, you can install the steering gear arm to debug the program steering gear parameters so that the steering gear can slightly raise the pen holder. If the amplitude is too large, it will produce a relatively large vibration, which will affect the accuracy of the drawing, and also increase the running time. Lift it about 5~10°.

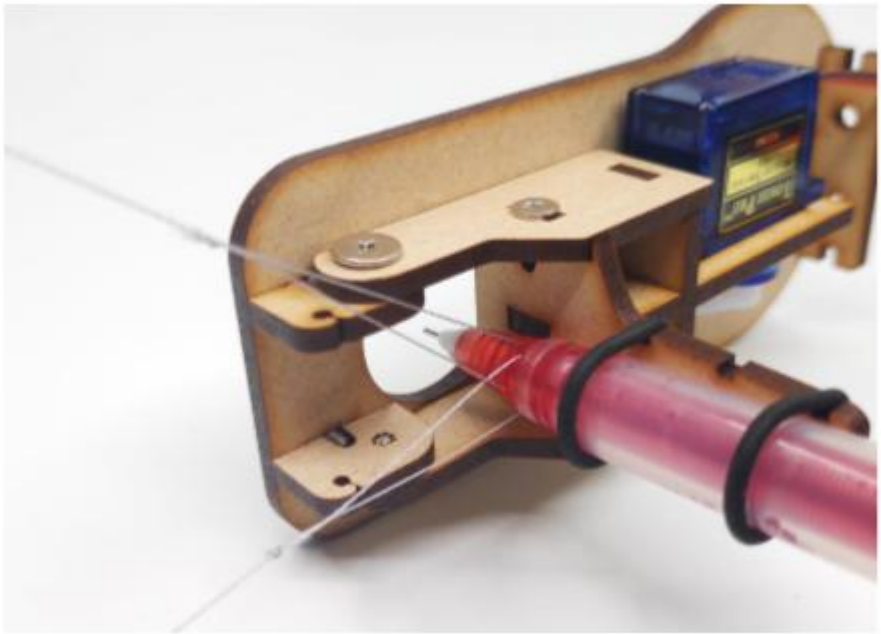


If you use the pen provided by our store for the rear counterweight bracket, you don't need to install it. If other specifications of drawing pens cause imbalance, you can increase the counterweight according to the situation.

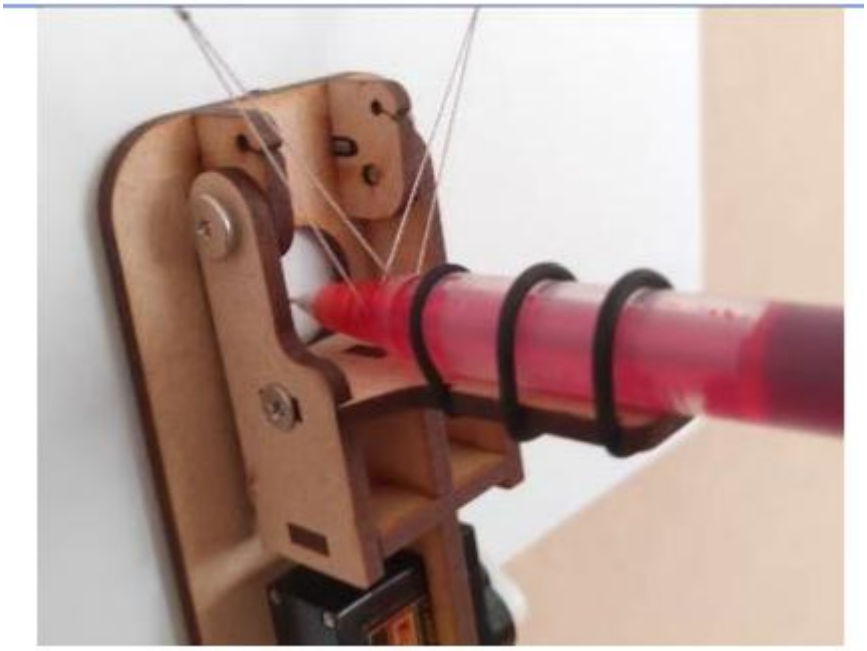




Fixed pen: Adjust the position of the pen so that the tip of the pen just touches the paper, and try not to raise the pen holder too much.

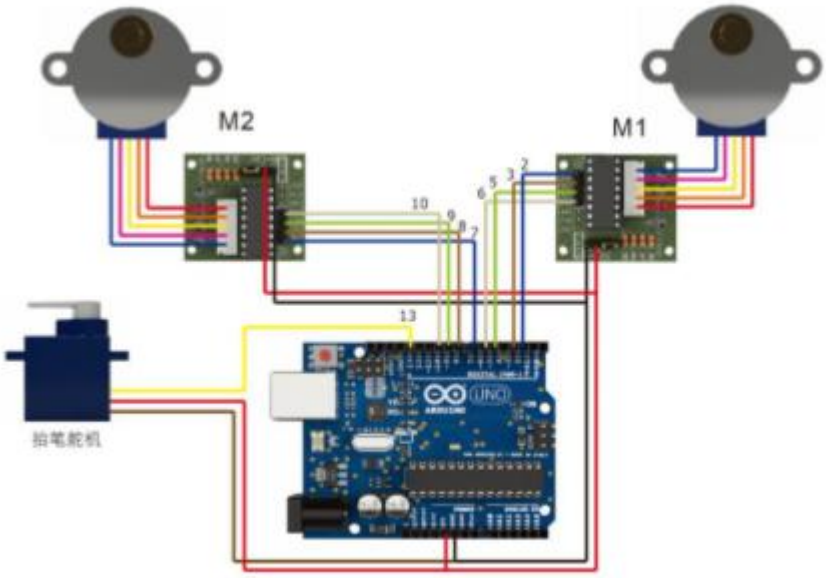


Tie the lanyard: tie a loop to the lanyard and put it in the concave ring of the pen. When debugging the program, you don't need to tie the pen, and buckle the lanyard to the ring on the front of the pen holder to observe the movement of the pen holder.

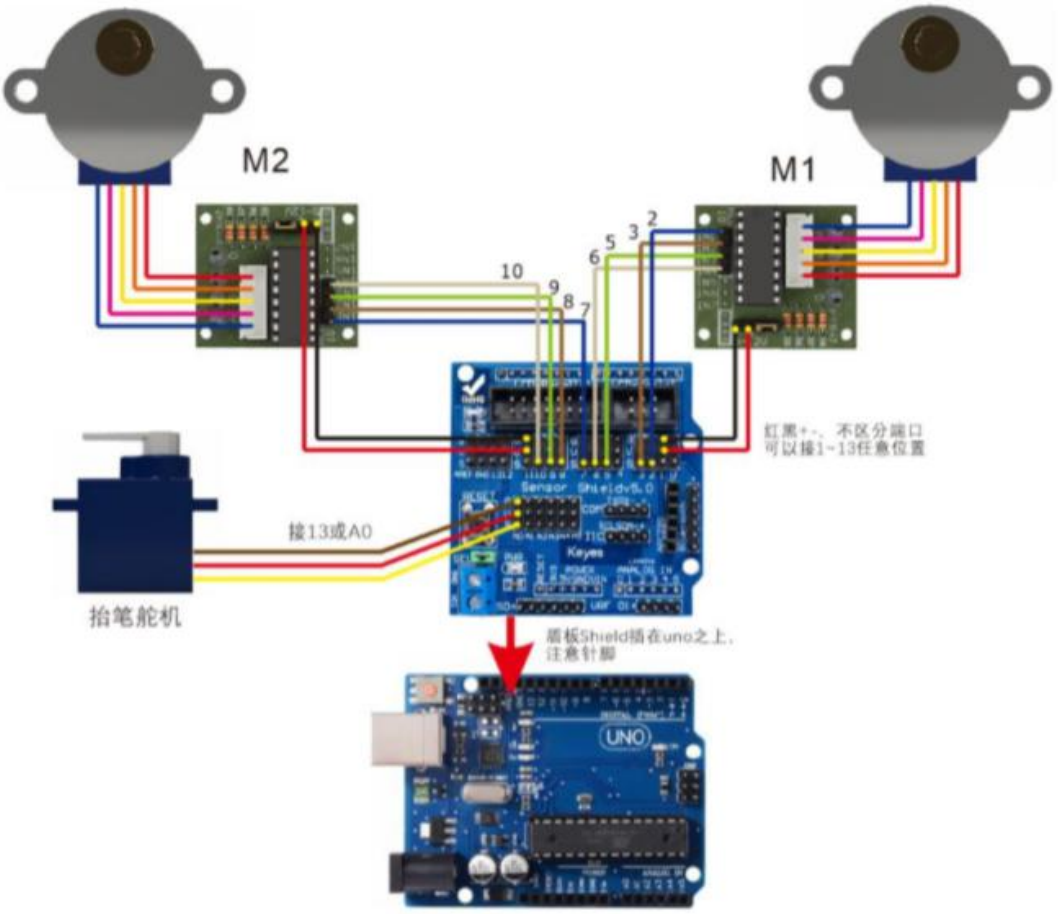


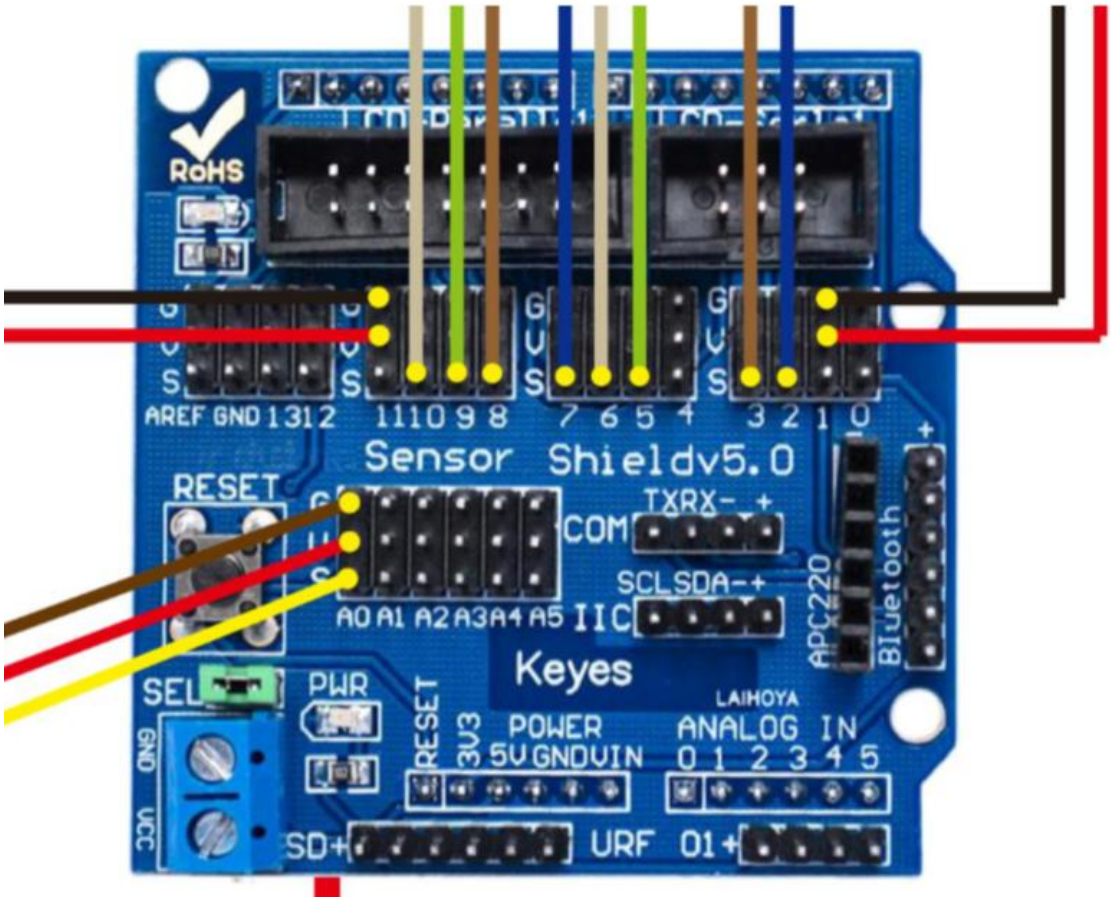
The typical installation style is shown above.

2. Wiring

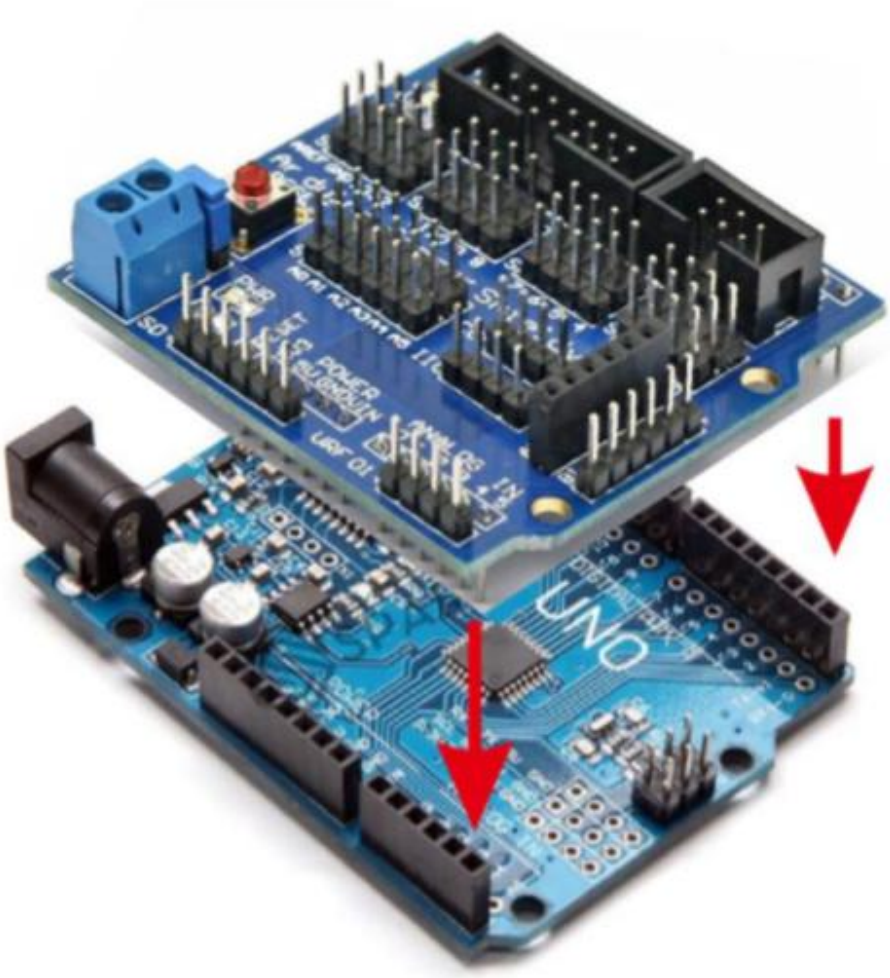


Wiring diagram (for using TF/SD card reader module, change the servo to port A0)

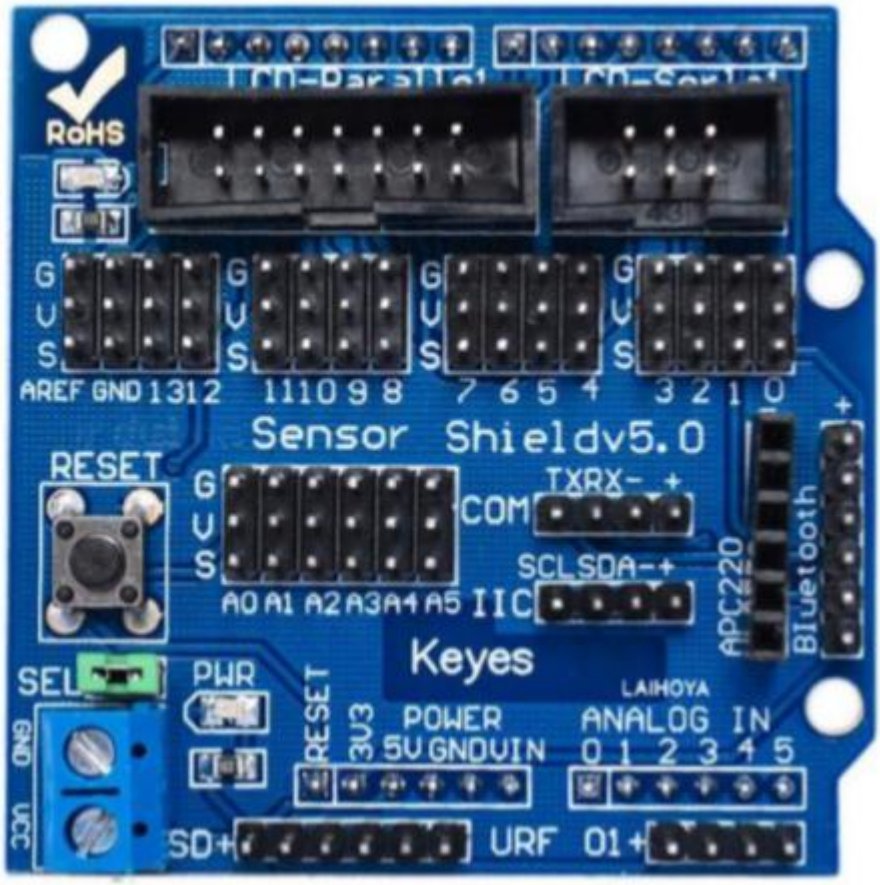

M2
M1
10
9
8
7
6
5
3
2
红黑+-，不区分端口
可以接1~13任意位置
接13或A0
抬笔舵机
盾板Shield插在uno之上，
注意针脚



Wiring diagram enlargement (the color of the wiring is only for the convenience of distinguishing, and has nothing to do with the actual wire color)



The shield board (also known as the extended version) is connected to the Uno, pay attention to the alignment of the pins.



Insert the shield board on the Arduino UNO, and align the pins of the shield board with the cable holes of the UNO. The role of the shield board is similar to the wiring board, and it is very convenient to plug in. It can be flexibly plugged into servos and other equipment. The pin numbers of the shield plate correspond to the ports of UNO one by one. Each port has an S signal connector and GND (abbreviated G or -), VCC (V or + or 5v) interface (G and V ports do not need to be numbered, any connection is fine) Note the row on the left of No. 13 Three are all GND, and the AREF port on the left is not available.

For the wiring position in the program, the VCC of all devices is connected to power +, GND is connected to power -, and those with a shield can be directly connected to the corresponding port.

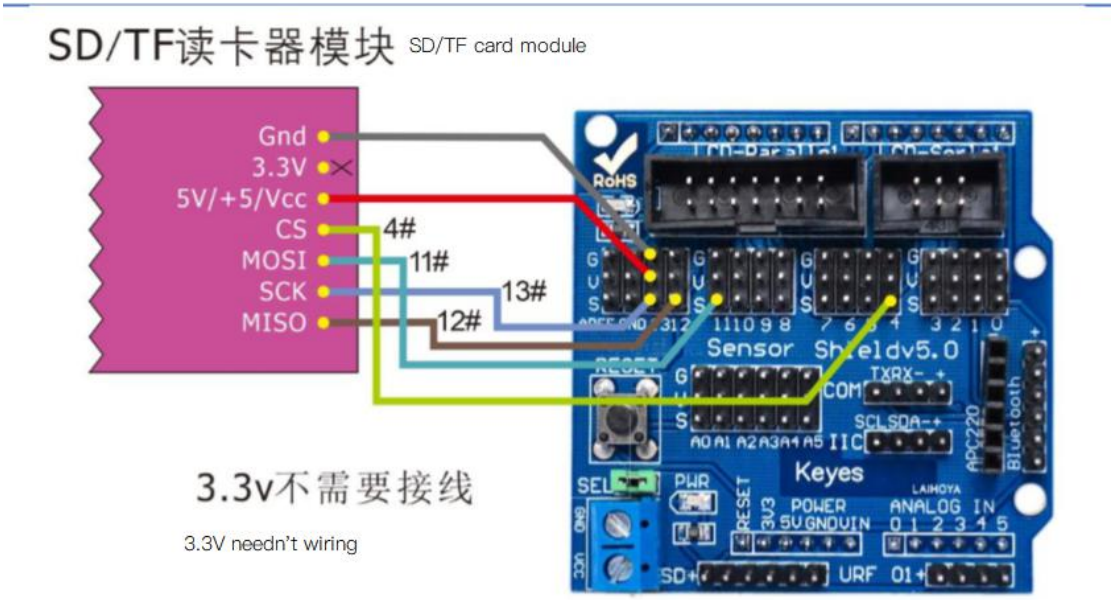
- Lift the pen servo 13# (or A0 port, use SD card reader). The servo wire is brown GND, red VCC, and yellow is the signal.
- Pull-wire stepper motors M1, M2: 4 signal wires In1, In2, In3, In4 correspond to Arduino 2, 3, 5, 6 and 7, 8, 9, 10# on the other side. The power wire is connected to VCC for +, GND for -. The stepper motor control board has a dedicated line to connect the motor, and the foolproof plug cannot be wrong.

IN1,IN2, IN3, IN4 connect Arduino
#2 3 5 6 right stepper motor
#7 8 9 10 left stepper motor

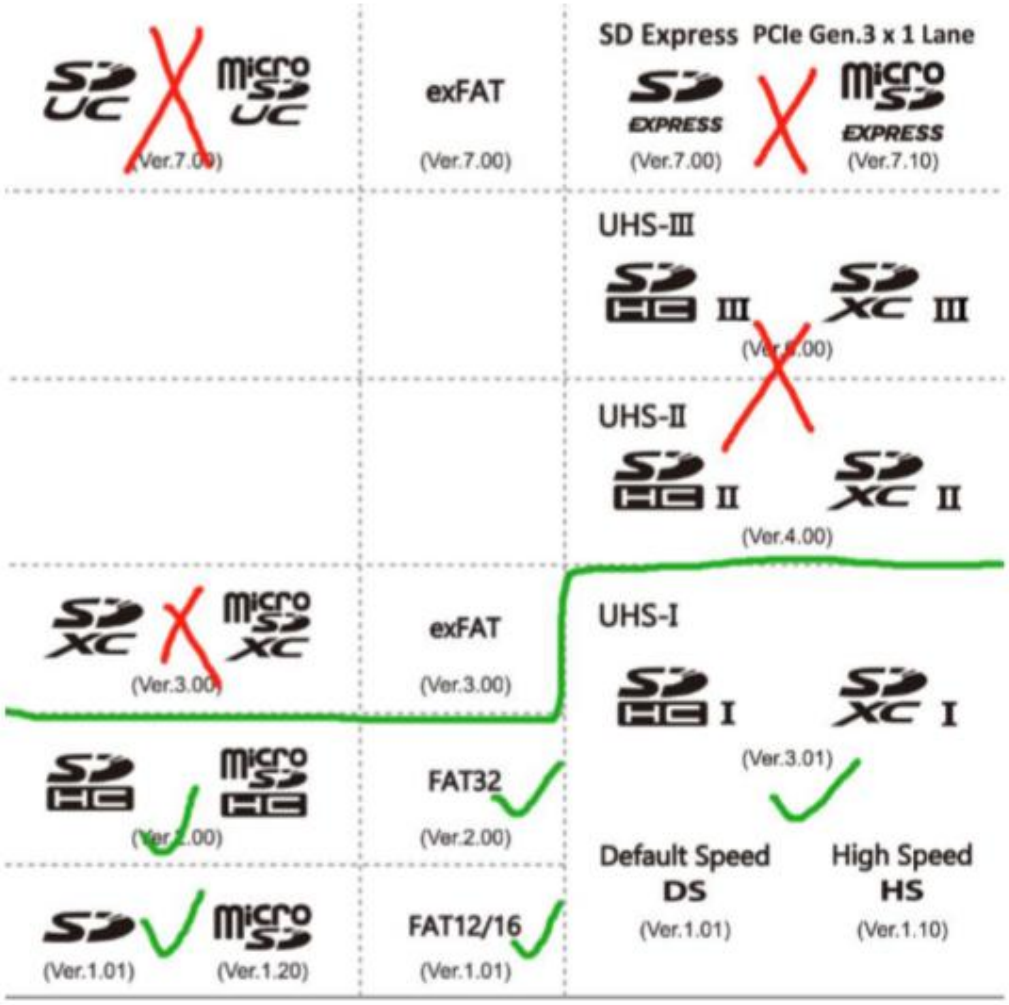
+ connect VCC of Arduino, – connect GND

(Optional) TF, SD card reader: CS connects to 4#, MOSI connects to 11#, MISO connects to 12#, SCK connects to 13# (Pen-raising servo

is changed from 13# to other ports such as A0, the program also needs to be done Corresponding changes, see the program notes) VCC is +, GND is-(G and V can be connected to any group of G and V ports on the shield), 3.3v does not need to be connected. (V, Vcc, 5V, + all refer to the positive pole of the power supply. G, GND,-are all negative)



Wiring mode of SD/TF card reader module



SD or TF card reader module does not support SDXC and above standard cards. Please choose a relatively old and small capacity card, which will have better compatibility. Generally, 16G and below cards are formatted in FAT32 format, not NTFS or exFAT format, and can be used. Some TF to SD card trays may also have incompatibility issues. If there is only a TF card, it is recommended to choose a TF card reader module.

3. Equipment performance parameters

Stepping motor model: 28BYJ-48 Variable speed ratio 64:1 Winding shaft diameter 35mm Average moving speed of drawing pen 13.7mm/sec Normal speed 9~27mm/sec (Different speeds between the pen holder and the motor will change, the speed of horizontal and vertical movement Also different.) The diameter of the spool also affects the speed change (spools of other diameters will be introduced later).

Pen-up steering gear: 9g steering gear.

Motherboard: Arduino UNO, or other compatible models.

SD card reader, Bluetooth and other storage communication and communication modules can be selected according to requirements.

4. Plotter working principle and program parameter adjustment

Two pull wires are tied to the pen holder, and the other end is wound on the spool, driven by a stepping motor, to pay off or take up the wire. For the principle of the algorithm, please read "How to Draw Einstein on the Wall".

The exit position of the pull wire at the bracket is point AB (see the figure below). The distance from the spool to the bracket does not

need to be calculated. The distance between these two points is the X_SEPARATION parameter (unit: mm) in the program. You need to modify your own X_SEPARATION value after measuring the actual width. The center of this segment is the origin of the X axis. In principle, the left is negative LIMXMIN, and the right is positive LIMXMAX.

X axis adjustment method

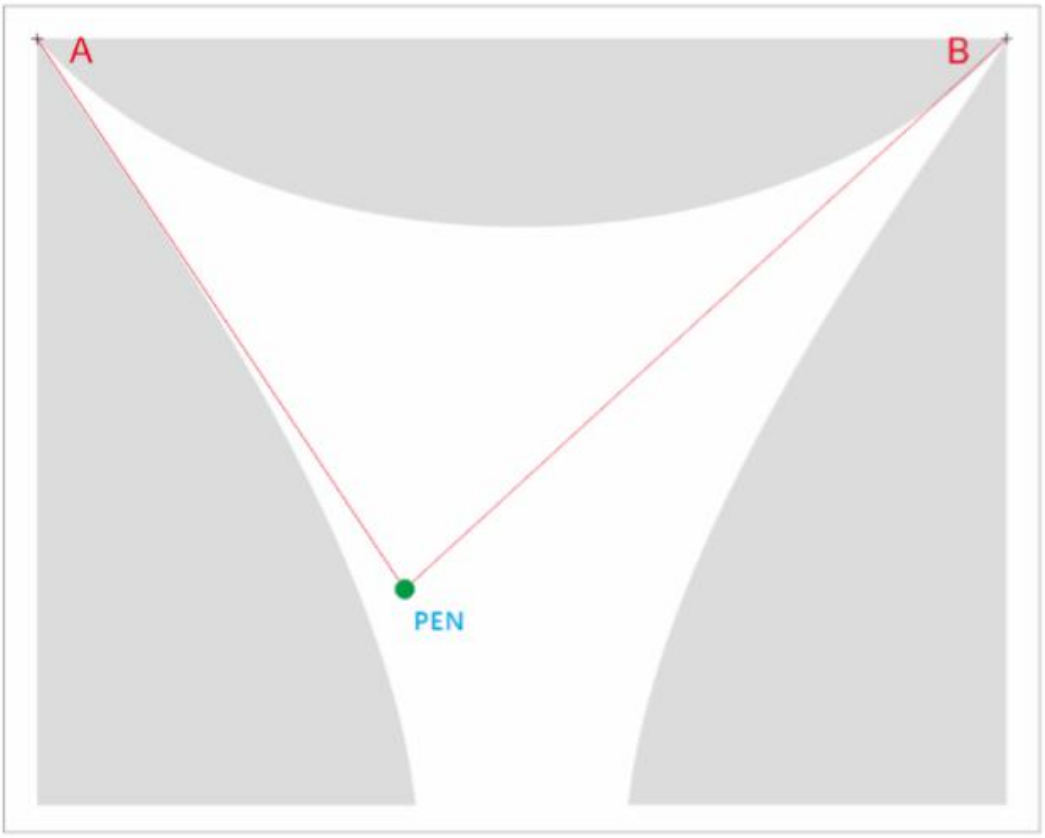
The position where the pen holder stays when turning on is the Y-axis origin. The vertical distance from the pen holder to AB is LIMYMIN (this value needs to be measured in advance, and try to keep the pen tip at this position every time you turn on the machine. If the error is too large, it will cause distortion, and the X axis is both). The downward is LIMYMAX. In theory, LIMYMAX is unlimited , As long as the spool and format are long enough. Generally, keep the pen in the center of the screen and set LIMYMIN and LIMYMAX to the same size.

------ Y-axis adjustment method

If the pen holder cannot be in the center of the screen when it is turned on, the actual position of the pen holder can be defined by the function teleport(x,y). The above parameters can be interchanged without restriction, and affected by the direction of rotation of the

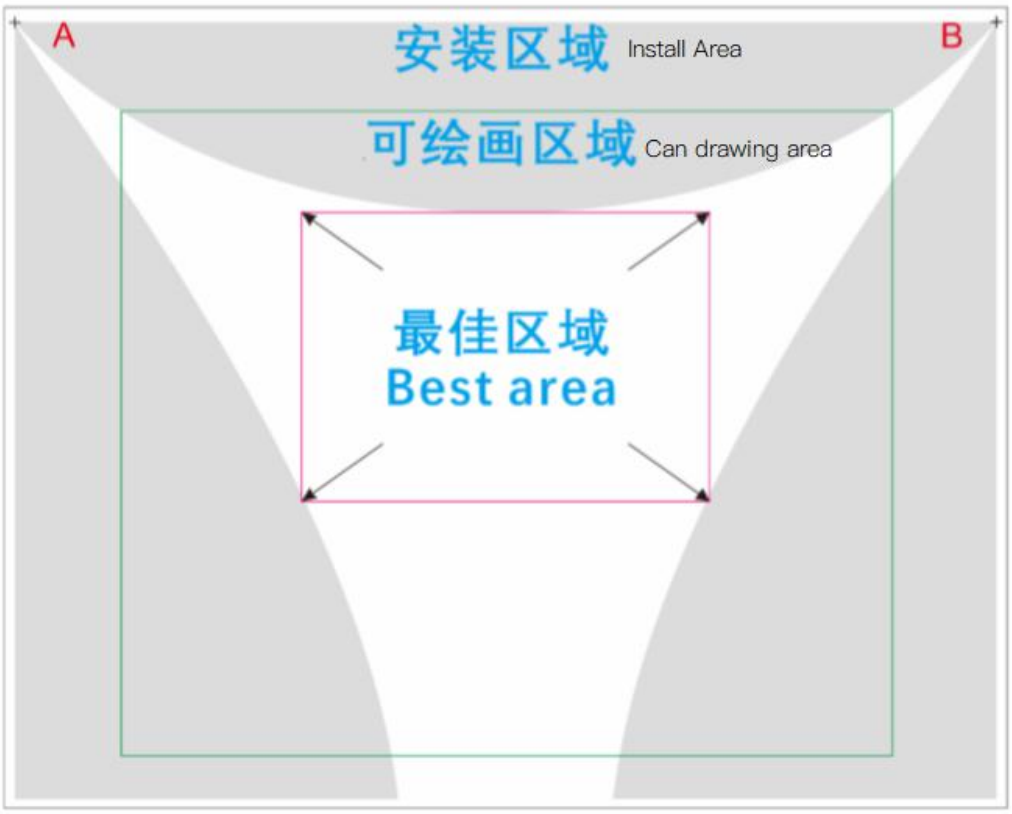
motor, the image may be mirrored or tilted at 90 degrees. Just adjust the corresponding parameters or programs. For details, see the program notes.

```
39
40  #define X_SEPARATION  570          //两绳上方的水平距离mm
41  #define LIMXMAX       ( X_SEPARATION*0.5)   //x轴最大值  0位在画板中心
42  #define LIMXMIN       (-X_SEPARATION*0.5)   //x轴最小值
43
44  /* 垂直距离的参数：  正值在画板下放，理论上只要画板够大可以无限大，负值区域在笔（开机前）
45  详细介绍见说明文档 https://github.com/zhihaipeng03/Walldraw
46  */
47  #define LIMYMAX         (-375)     //y轴最大值 画板最下方
48  #define LIMYMIN         (375)    //y轴最小值 画板最上方   左右两线的固定点到笔的垂直
49                  //值缩小画图变瘦长，值加大画图变矮胖
50
```



The image cannot be expanded indefinitely. Theoretically, the image is only affected by the distance of the AB point. The wider the image, the larger the image. In fact, it is not so ideal. The closer the vertical distance between the pen holder and AB, the greater the pulling

force of the motor, and finally approaching infinity. Obviously, the stepping motor can't reach it, although our cable can withstand a pulling force of 10Kg. So the highest point of the image cannot reach the position of LIMYMIN. Don't lean too much on both sides, because the horizontal tension becomes too weak. So the best drawing area is shown in the note below. After exceeding the optimal area, there will be a certain amount of distortion, the more the exceeding area, the greater the distortion.



Ready to start?

Next, brush the program. If you don’t know how to program, or even use Arduino, please read 1 "Arduino IDE Download and Installation Tutorial", 2 "Arduino Program Running Tutorial"

You can also watch the video tutorial at Watermelon Video:

https://www.ixigua.com/home/2123847662571084/

(Masters can ignore it directly. It is easy to adjust various parameters by refreshing the program.) This operation is suitable for novices who don't understand how the servos and stepping motors work.

First run 2Steper.ino. The function of this program is to make the stepper motor work and draw a cycloid diagram. It is relatively simple. You can change the pattern by adjusting the number of turns. The position may be much worse. When running the program directly, the swing arm may turn to a completely unrelated position, which is very troublesome.

The main program is WallDrawDemo.ino, which will draw several patterns for testing.

Don't install the pen yet (the lanyard can be hung on the pen holder), run the program, let the pen run overhead for a while, and see if the operating range is within the paper range. If it exceeds, the parameters need to be adjusted. See the program notes for the functions of specific parameters.

How to draw complex graphics, such as photos taken on mobile phones.

1. Not any photo can be drawn, only vector graphics can be drawn. Fortunately, some photos can be converted into vector graphics through software. (You can use Coreldraw, Inkscape and many other software to process) or try a simple vector diagram first.

2. The vector diagram needs to be converted into a gcode file. (You can use Inkscape, Aspire, and many other software for making Gcode.) If you can't, you can also try some of the gcodes provided in our software package. Gcode is a text file that can be opened and edited with WordPad. You can browse the values in gcode before use. The units of these values are actual millimeters. If there are tens of thousands of values, it may be catastrophic to let the stepper motor rotate for a few hours before stopping. There are many specific rules and usage methods of gcode online, so you can learn by yourself.

3. The Gcode file is saved in the memory card. The arduino reads the file from the card and parses the position coordinates into the action of the stepping motor, and draws the rope to drive the pen to draw. (The WallDraw.ino program in the program package can perform this step) (Note that the memory card is preferably in fat32 format. The ntfs format may not be able to read files, especially

cards with a capacity of 32G or more. Pay attention to the file name of the gcode file and the program The definition is the same, usually "1.nc", if different, please change to the same name)

Frequently Asked Questions

1. The spool is unscientific, and the circumference will change if it is wound too much. It is not as good as the design of the synchronous belt.

Answer: The spool has a diameter of 35mm, a wire thickness of 0.16mm, and 20 turns. The wire length increases by 2.2 meters, and the shaft diameter changes by 0.2mm. The image error for a 2-meter format is about 0.314mm, which can be ignored.

2. The image is only inverted, upside down, or even rotated by 90 degrees, there is still a lot of distortion. Answer: Depending on the motor, the direction definition of the program may affect the reverse mirror image. Just change the corresponding parameters. For example, the sign of MAX and MIN of XY, or the line sequence of the motor, or the signs of 4 parameters such as M1_REEL_OUT can change the direction. If it is rotated by 90 degrees, you can change the greater than and less than <,> symbols in the moveto function to turn it around.

```
291   Serial.println(d2);
292   #endif
293
294   long ad1=abs(d1);
295   long ad2=abs(d2);
296   int dir1=d1<0 ? M1_REEL_IN : M1_REEL_OUT;
297   int dir2=d2<0 ? M2_REEL_IN : M2_REEL_OUT;
298   long over=0;
299   long i;
300
301
302   if(ad1>ad2) {
303     for(i=0;i<ad1;++i) {
304       m1.step(dir1);
```

3. The motor does not rotate

Answer: Loud, vibration may occasionally move weakly? Do not change the wire sequence if there is a wire sequence. The four lights on the control panel do not turn on. It is estimated that there is no wiring. Just find a +- on the shield board that also needs to be connected to the power cord.

4. The operation is normal, the drawing distortion is very large

Answer: The position parameter is wrong. The position of the pen holder is 0 when it is turned on. If the difference between the actual position and the program definition is too large, the distortion will be larger.