



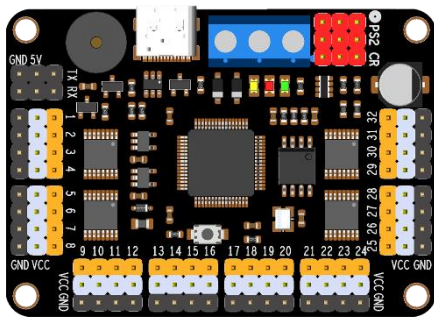
# **Servo Motor Controller Instructions for use**

**Ver 3.15**

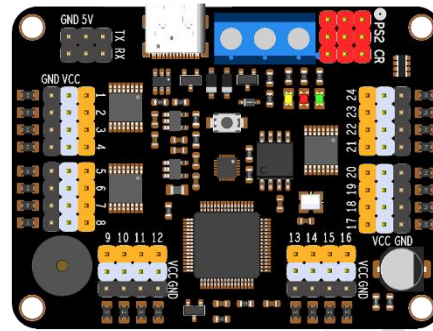
**Parameters:**

<b>Hardware</b>	32 channels	24 channels	16 channels
<b>Operating Voltage</b>	5V		
<b>Servo motor Input Voltage</b>	According to the servo motor		
<b>CPU</b>	32bit		
<b>Baud Rate (USB)</b>	115200		
<b>Baud Rate</b> (Bluetooth, WIFI, UART)	4800、9600、19200、38400、57600、115200		
<b>Flash Capacity</b>	16M		
<b>Servo motor synchronous quantity</b>	32	24	16
<b>Max Action Groups</b>	255		
<b>control precision</b>	1us		
<b>Servo motor signal isolation</b>	Yes		
<b>Current limiting protection</b>	No	Yes	Yes
<b>MPU6500</b>	No	Yes	NO
<b>External sensor support</b>	No	No	Yes
<b>3D Virtual</b>	All	All	Part
<b>Indicator led</b>	1.CPU power indicator led (red) 2.Servo motor power indicator led (green) 3. wireless remote control (Yellow)		
<b>Size</b>	64mm X 45mm	64mm X 47.5mm	58.5mm x 45mm
<b>Communication Protocol</b>	UART		
<b>Computer Software</b>	Windows 10 or later Mac OS 10.8 or later Linux (kernel 3.0 or later)		
<b>Low pressure alarm</b>	Default Open		
<b>Servo motor initial value</b>	Default 1500		
<b>Support servo motor type</b>	9G~55G		
<b>Second development</b>	C51、Arduino、ARM、MSP、DSP、WIFI、Bluetooth、Compute		
<b>wireless remote control</b>	1. one servo motor control 2. action groups control		

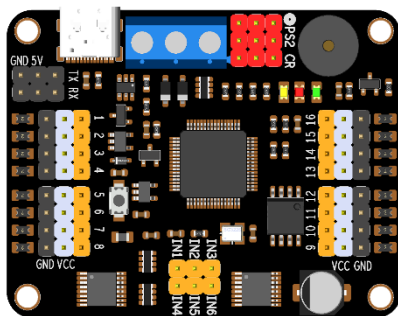
32 channels:



24 channels:



16 channels:



# Instruction:

## Communication Protocol:

serial communication	baud rate	parity bit	data bits	stop bits
TTL	9600(default)	none	8	1

## Instruction format:

name	Instruction	description
Controller single servo motor	#1P1500T1000D800\r\n	Data 1 refers to the channel of the servo motor Data 1500 refers to the position of the servo motor, with a range of 500-2500 Data 1000 refers to the execution time and represents the speed, with a range of 0-9999 Data 800 refers to the delay time between instructions, with a range of 0-9999
Controller multiple servo motor	#1P1500#2P1500T1000D800\r\n	Data 1、2 refers to the servo motor channel Data 1500 Refers to the servo motor location, in the range 500-2500 Data 1000 refers to the time of execution and represents the speed, in the range 0-9999 Data 800 refers to the Instruction interval of delay time, in the range 0-9999
Run action groups	G1F3\r\n	Data 1 refers to the group's channel Data 3 refers to the frequency of runs
Stop action groups	~ST	Stop running action groups (Note: not pause)
Restart CPU	~RE	Restart CPU

**Note:** "\r\n" in hexadecimal is "0x0D 0x0A"; all instructions are in ASCII code.

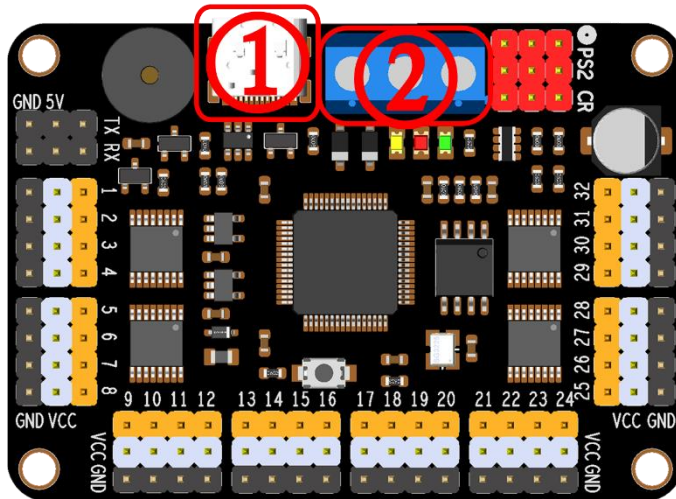
"0x0D" == "\r" == "CR"

"0x0A" == "\n" == "LF"

Note: If the function or software used in the program has a "\r\n" feature, it is not necessary to add it at the end. After the instruction is executed, the controller will provide feedback with "OK".

## Wiring methods:

**I . Power supply connection method, as shown in Position 1 in *Figure 1*:**



*Figure 1*

**VCC:** This is the input for the servo motor power supply VCC, which can be connected to a 4.2V - 9.6V power supply. Please connect the positive pole of the power supply.

**Note:** The VCC interface of the controller is the power input of the servo motor. The VCC interface should be selected according to the requirements of the servo motor, for example, if one servo motor requires a peak voltage of 6V and a current of 2A, and ten servo motors require a power supply of 6V voltage and 10A current.

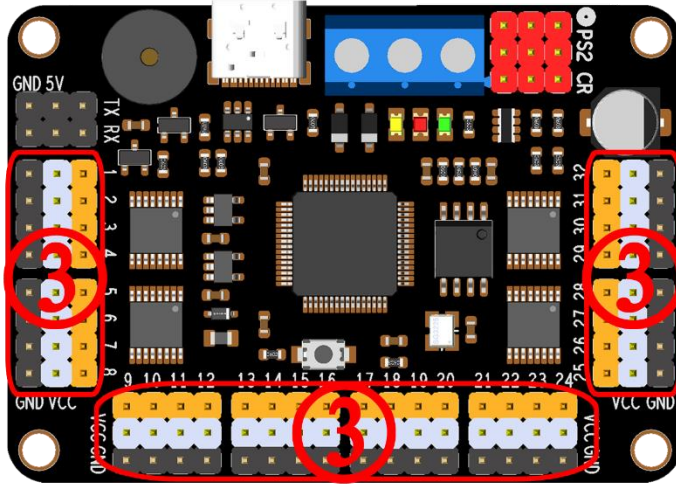
**GND:** This is the overall GND of the servo motor controller, which can be connected to the GND of the servo motor power supply or the CPU power supply. Please connect the negative pole of the power supply.

**VDD:** This is the CPU power supply input of the servo motor controller, with a power supply range of 5V-9.6V. Please connect the positive pole of the power supply.

**USB (①):** This is both the CPU power supply input and the data communication interface of the servo motor controller.

**Note:** The USB(①) interface and the VDD interface (②) cannot be connected at the same time. Only one can be selected as the power supply end of the controller CPU.

## II. Servo motor wiring method, as shown in Position ③ in *Figure 2*:



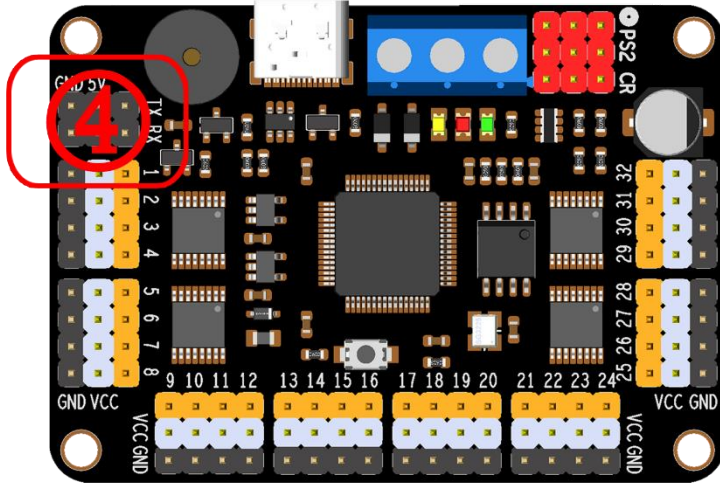
*Figure 2*

**Yellow pin header:** This is the I/O input of the servo motor, generally yellow or beige in color.

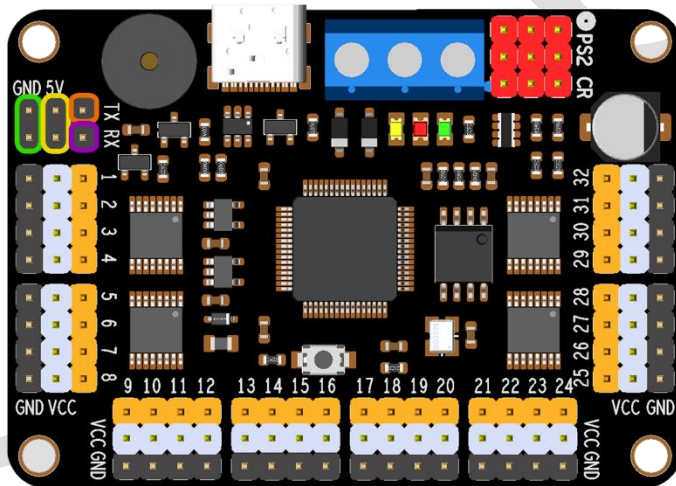
**White pin header:** This is the VCC input of the servo motor, generally white, red or dark red in color.

**Black pin header:** This is the GND input of the servo motor, generally brown or black in color.

**III. UART wiring method, as shown in Position ④ in Figure 3. Please refer to Figure 4 for details:**



*Figure 3*



*Figure 4*

**Green circle:** This is the GND input of the CPU power supply of the servo motor controller.

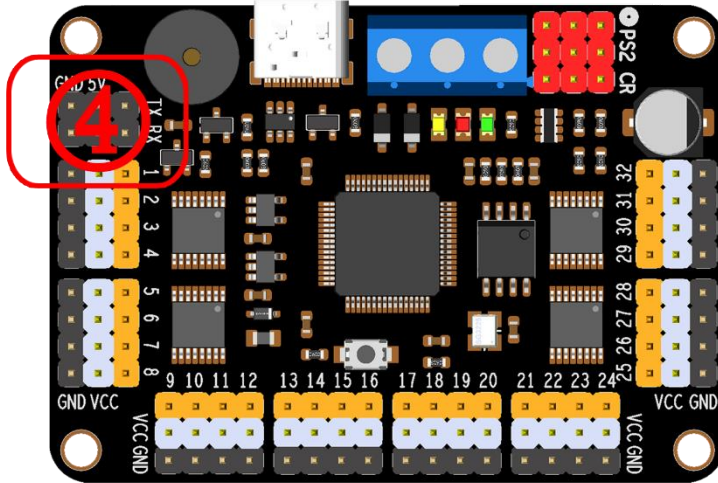
**Yellow circle:** This is the VCC input of the CPU power supply of the servo motor controller, which can only be connected to 5V.

**Purple circle:** This is the RX port of the UART of the servo motor controller, generally connected to the TX port of other UART devices.

**Orange circle:** This is the TX port of the UART of the servo motor controller, generally connected to the RX port of other UART devices.



#### IV. Bluetooth and Wi-Fi sensor wiring method, as shown in Position ④ in *Figure 5*:



*Figure 5*

Position ④ in *Figure 5* uses four DuPont wires to connect with the Bluetooth or Wi-Fi module, 5V-VCC, GND-GND, RX-TX, TX-RX.

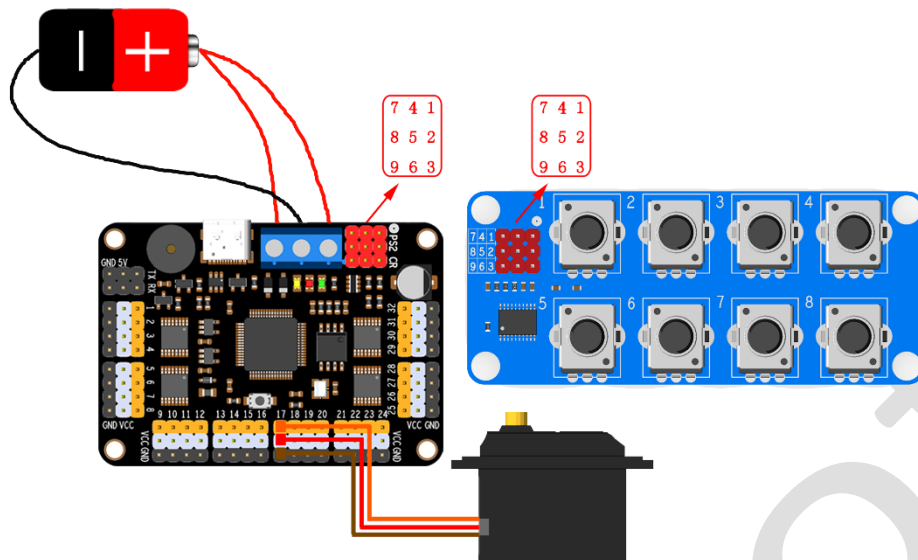
Pair the mobile phone with the Bluetooth module and install the mobile control software to perform control. To use the Wi-Fi module, install and open the mobile control software, and enter the TCP address set by the Wi-Fi module for control.

**Note:** Before using the mobile phone remote control in practice, connect the Bluetooth or Wi-Fi module to the computer and use a serial port debugging software to see if the corresponding instructions can be received.

The first time you use the mobile software, you need to enter the verification code, which is: **RTrobot** (pay attention to the case).



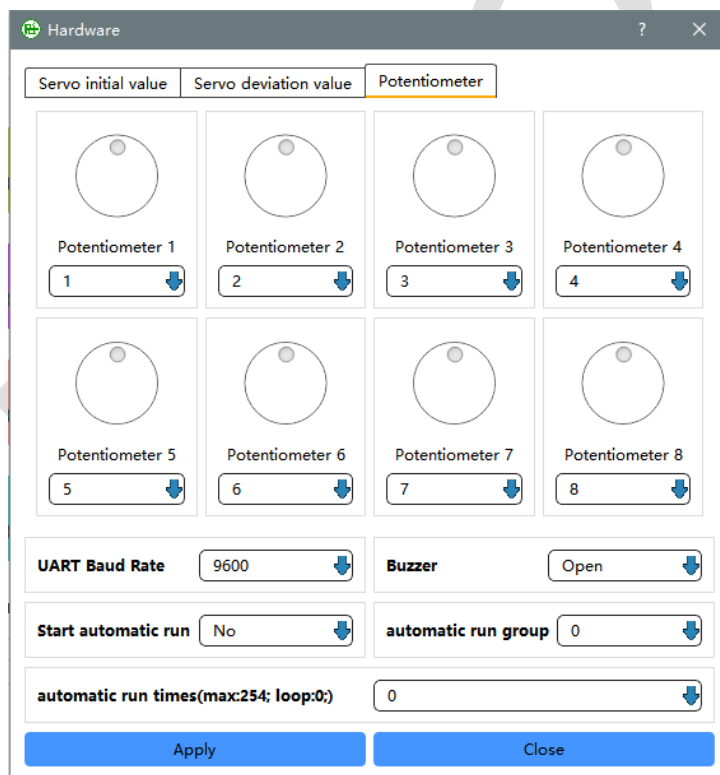
**V. Potentiometer wiring method, as shown in *Figure 6*:**



**Figure 6**

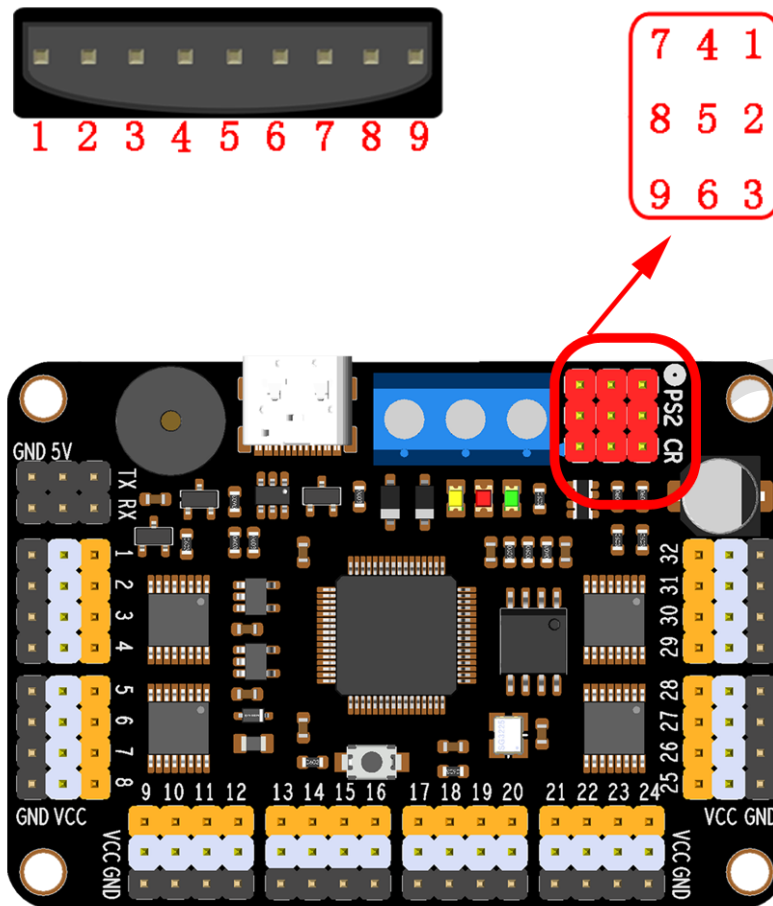
The potentiometer module is connected to the servo motor controller, as shown in Figure 6, connect 1 - 1, 2 - 2, and 3 - 3...

Each potentiometer can be set to control which channel of servo motor through the upper computer software "Setting" -> "Hardware".



**Figure 7**

## VI. Wireless joystick wiring method, as shown in *Figure 8*:



*Figure 8*

Connect the wireless remote receiver with the servo motor controller, as shown in figure 8, 1 - 1, 2 - 2, 3 - 3...

Don't forget that the joystick also needs two batteries for power. (After the wiring is correct, the LED lights of the power receiver and the remote control will be on constantly, indicating that the pairing is complete.)

The wireless remote control has two control modes.

Mode 1 (yellow light off) is for controlling a single servo motor.

Mode 2 (yellow light on) is for controlling an action group.

The functions of the buttons are different in different modes, but some buttons have the same function in both modes.

**Note:** After the power is turned on, you must press "START" once to start the servo motor.

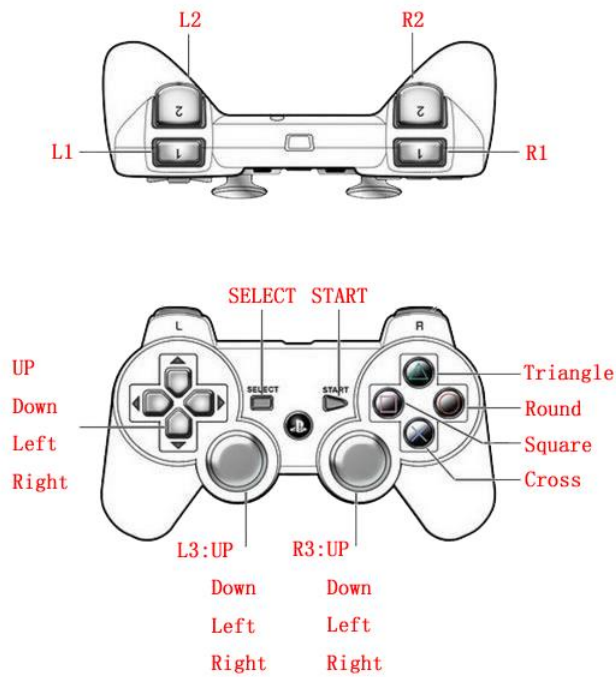


Figure 9

**Same function:**

**SELECT:** Mode Switching

**START:** Activate

**Single Servo Motor Control (32 Servo Mode):**

**Square:** Move all servo motors to 2500

**Cross:** Move all servo motors to 1500

**Round:** Move all servo motors to 500

**Triangle:** Reserved

Hardware	32 channels	24 channels	16 channels
First group servo motor serial number	1、 3、 5、 7、 9、 11、 13、 15	1、 3、 5、 7、 9、 11	1、 3、 5、 7
First group control button	L2: Switch to the previous servo motor in the first group R2: Switch to the next servo motor in the first group L3-Left: Increase the value of the selected servo motor in the first group L3-Right: Decrease the value of the selected servo motor in the first group		
Second group servo motor serial number	2、 4、 6、 8、 10、 12、 14、 16	2、 4、 6、 8、 10、 12	2、 4、 6、 8
Second group control button	L1: Switch to the previous servo motor in the second group. R1: Switch to the next servo motor in the second group. R3-Left: Increase the value of the selected servo motor in the second group. R3-Right: Decrease the value of the selected servo motor in the second group.		
Third group servo motor serial number	17、 19、 21、 23、 25、 27、 29、 31	13、 15、 17、 19、 21、 23	9、 11、 13、 15
Third group control button	Left: Switch to the previous servo motor in the third group. Right: Switch to the next servo motor in the third group. L3-Up: Increase the value of the selected servo motor in the third group. L3-Down: Decrease the value of the selected servo motor in the third group.		
Fourth group servo motor serial number	18、 20、 22、 24、 26、 28、 30、 32	14、 16、 18、 20、 22、 24	10、 12、 14、 16
Fourth group control button	Down: Switch to the previous servo motor in the fourth group. Up: Switch to the next servo motor in the fourth group. R3-Up: Increase the value of the selected servo motor in the fourth group. R3-Down: Decrease the value of the selected servo motor in the fourth group.		

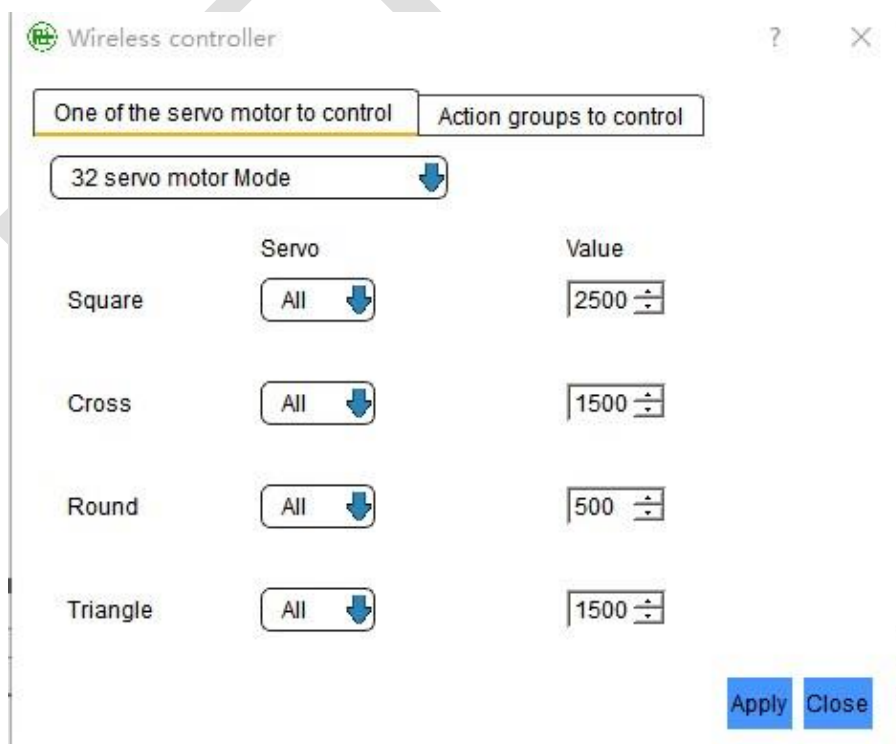


Figure 10

Execution of Action Group:

Button	L2	L1	R2	R1	Up	Left:
action group	0	1	2	3	4	5
Button	Down	Right	L3-Up	L3-Left	L3-Down	L3-Right
action group	6	7	8	9	10	11
Button	R3-Up	R3-Left	R3-Down	R3-Right	Square	Cross
action group	12	13	14	15	16	17
Button	Round	Triangle				
action group	18	19				

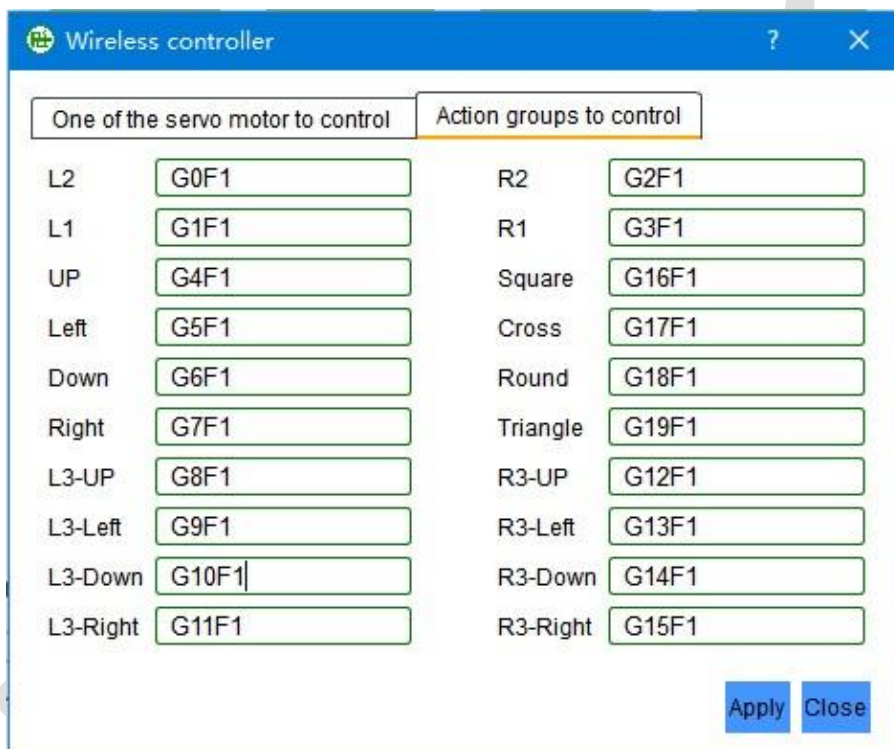
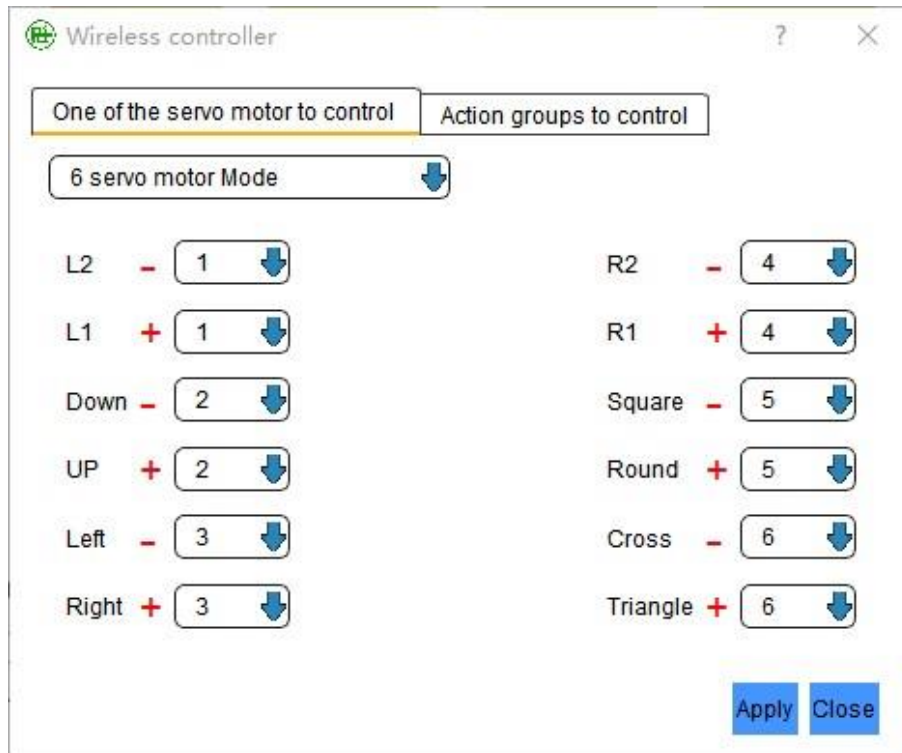


Figure 11

**Single servo motor control (6 Servo Mode):**

Each time the button is pressed, the specified servo motor value will increase or decrease. For example, pressing the "L2" button will decrease the value of servo motor 1 to change its angle.

*Figure 12*

If you need to customize the buttons on the wireless joystick, please use the software and click "[Setting](#)"->"[Wireless controller](#)" to edit.

**Note:** When the servo motor controller is plugged into the USB boot, the wireless joystick does not work.

## Wiring Examples:

### I . Using a computer to control:

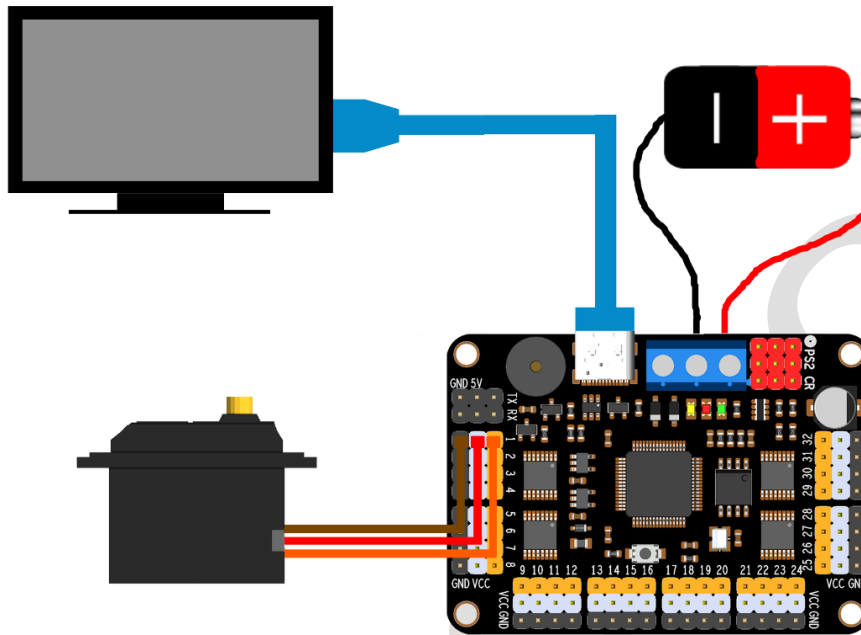


Figure 13

Connect the servo motor and its power supply first, and then use a USB cable to link the computer to the servo motor controller.

Refer to **Wiring methods: I** for connecting the servo motor power supply (remember not to connect the VDD power supply port).

**Note:** The servo motor power supply should be selected according to the requirements of the servo motor.



## II. Automatic run of the controller:

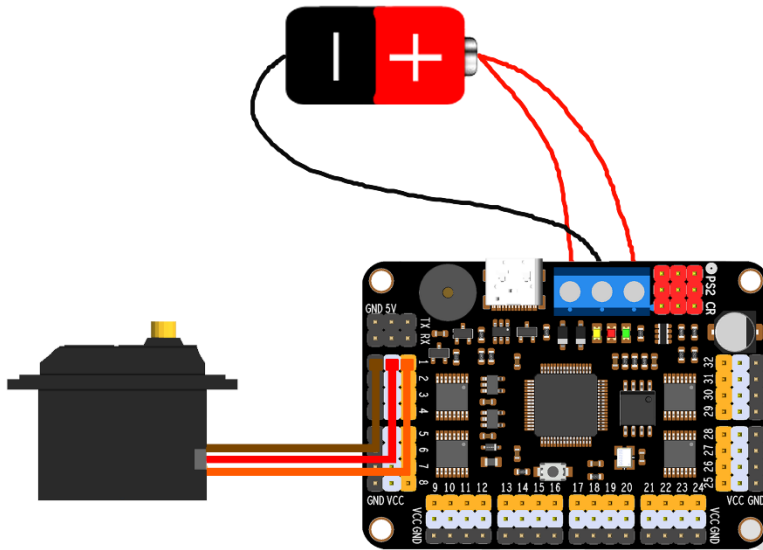


Figure 14

Before the servo motor automatic operation, set the automatic operation parameters using the software, see the software usage section for details.

**Note:** If USB is needed to supply power to the CPU, the red wire of the VDD port should not be connected. After setting the automatic operation parameters with the software, plug and unplug the USB port to start automatic operation.

### III. Using MCU to control

#### Servo motor controller powered by MCU:

Take Arduino Uno as an example here, and refer to this section for other MCUs. Connect the servo motor controller 5V to Arduino Uno's 5V, servo motor controller GND to Arduino Uno's GND, servo motor controller TX to Arduino Uno's RX, and servo motor controller RX to Arduino Uno's TX. See **Figure 15**. Note: At this time, all power is supplied by one battery.

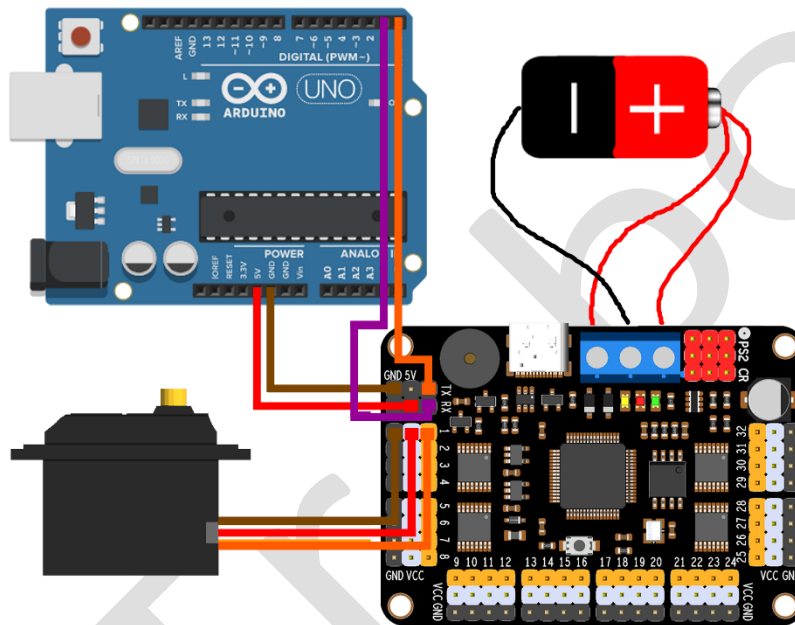
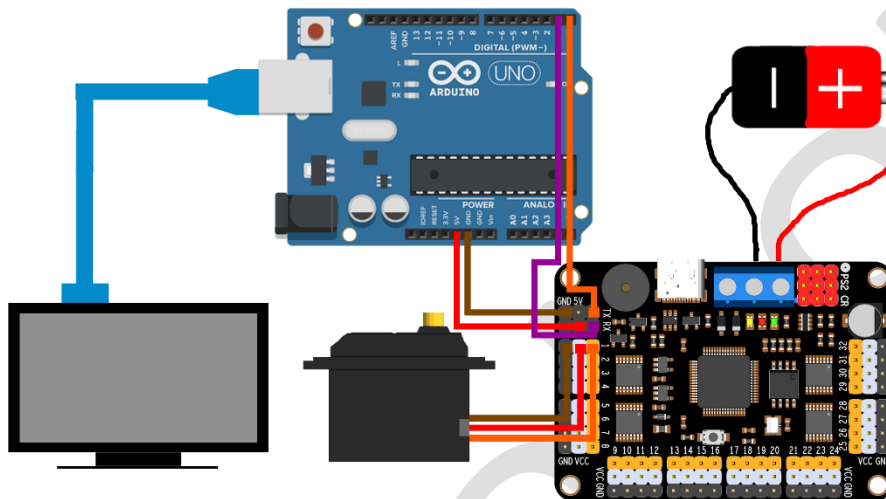


Figure 15

**Servo motor controller supplies power to MCU:**

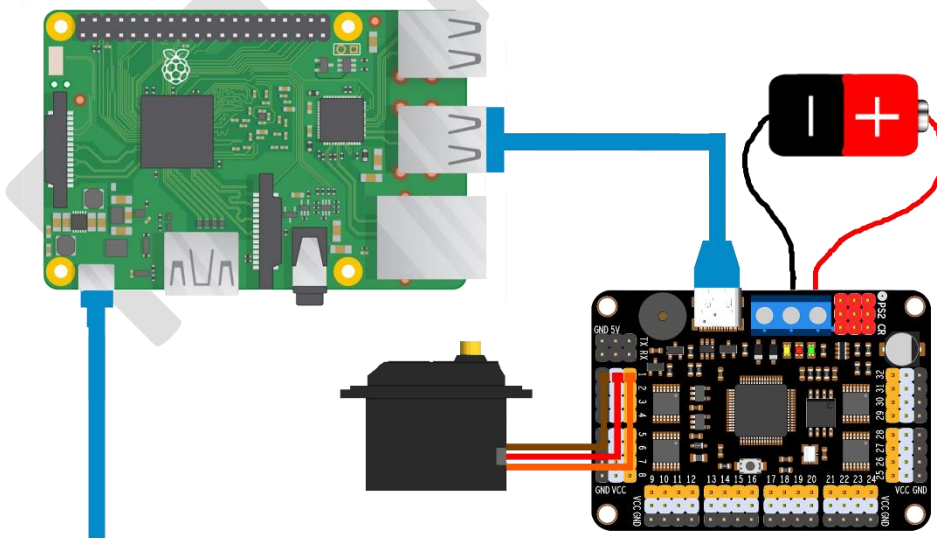
Connect the servo motor controller 5V to Arduino Uno's 5V, servo motor controller GND to Arduino Uno's GND, servo motor controller TX to Arduino Uno's RX, and servo motor controller RX to Arduino Uno's TX. See **Figure 16**.

Note: The computer supplies power to Arduino Uno and the controller, while the servo motor is powered independently.



**Figure 16**

Raspberry Pi users can use a USB cable to connect the servo motor controller to the Raspberry Pi and treat it as a computer.



**Figure 17**

# Software Operation Instructions:

**Note: The serial port needs to be opened to use all the functions of the software.**

## I. Language Setting:

Click "Setting" -> "Language" to select the language.

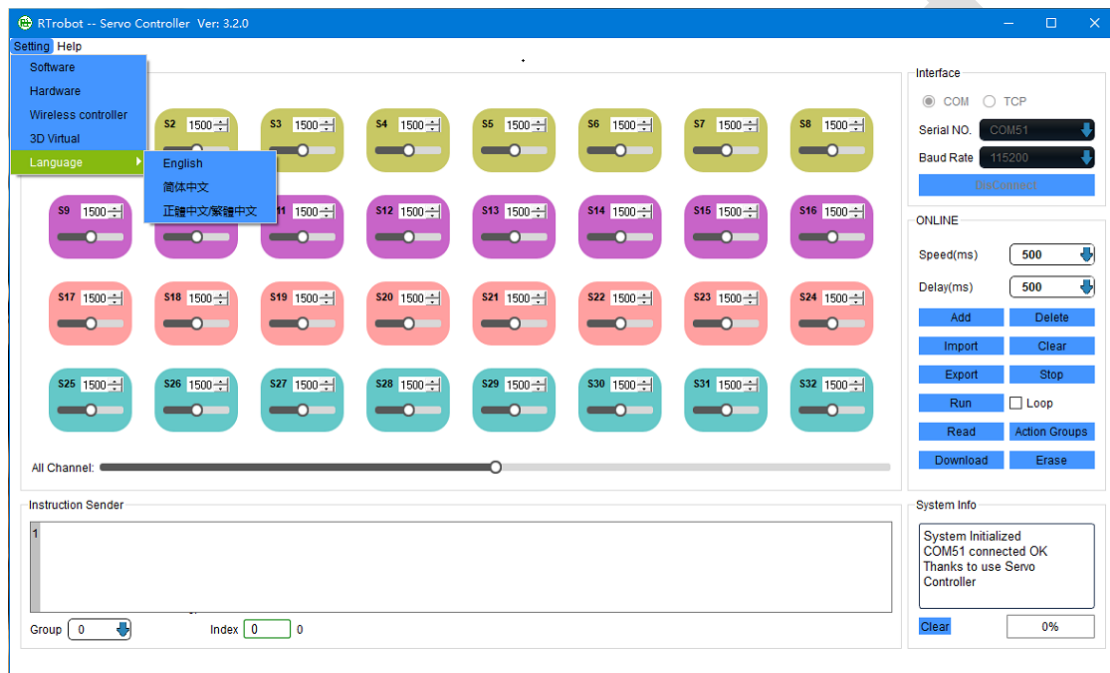


Figure 18

## II. Software Settings:

Click the "⚙️" in the servo motor window to name each servo motor individually and set the maximum and minimum values, colors, and locked position.

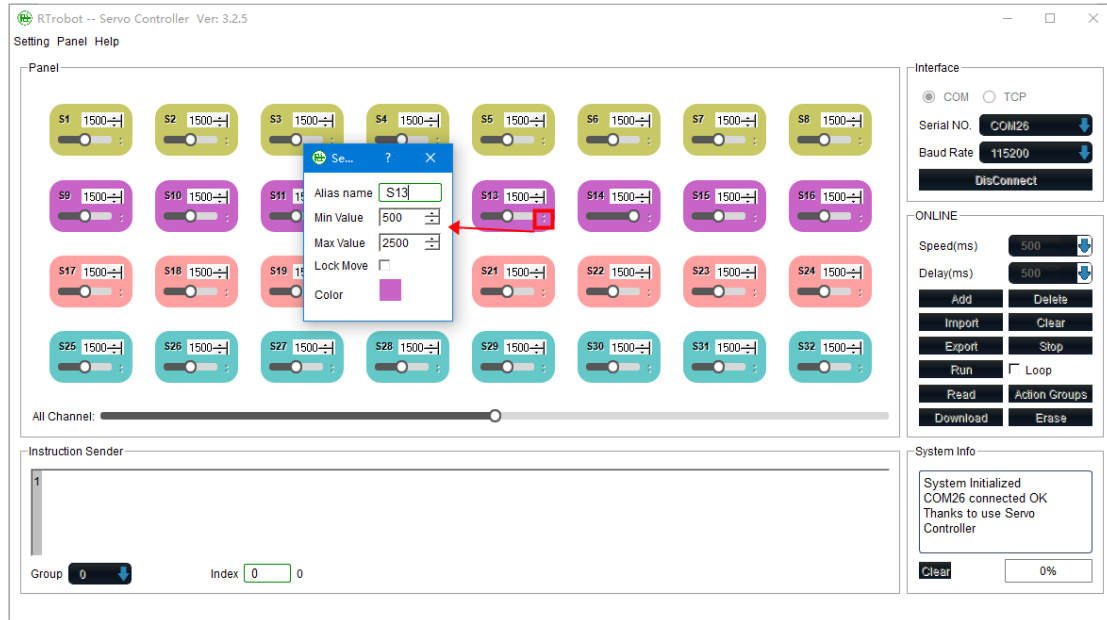


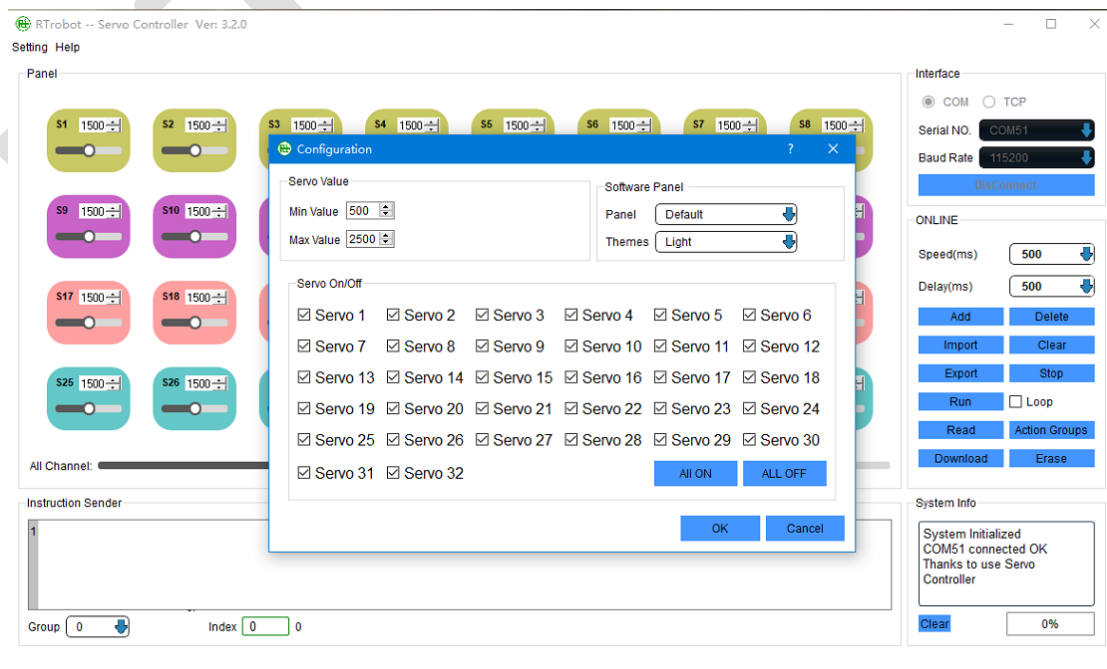
Figure 19

Click "Setting" -> "Software" to set the software, as shown in **Figure 20**.

Software Panel: Set the software control panel.

Servo On/Off: Displays the number of the servo motor that needs to be controlled.

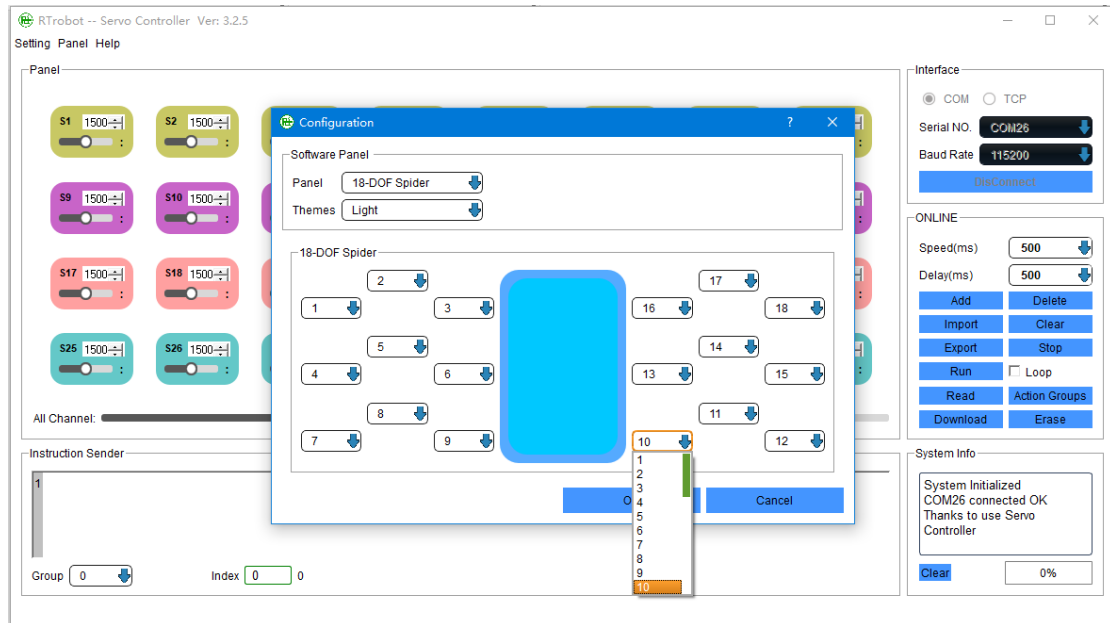
After completing the software settings, click "OK" to automatically restart the software.



**Figure 20**

After selecting the Software Panel interface, you can specify the servo motor number for each position, as shown in **Figure 21**.

**Note:** If there are duplicate servo motor numbers, they cannot be saved.



**Figure 21**

### III. Servo motor controller settings:

Click "Setting" -> "Hardware" to set the controller, as shown in *Figure 22*.

**Servo Initial Value:** Set the initial value for each servo motor when powered on.

**Servo Deviation Value:** Set the deviation value for each servo motor (valid value: -99~99), as shown in *Figure 23*.

**UART Baud Rate:** Set the serial port baud rate at position ④ in *Figure 5*.

**Buzzer:** Low voltage alarm switch.

**Start Automatic Run:** Switch for automatic running of action group at startup.

**Automatic Run Group:** Set the action group number to be automatically run at startup. This option is invalid when the automatic running is set to action group mode only.

**Automatic Run Times:** The number of times the action group runs at startup. This option is invalid when the automatic running is set to action group mode only.

**Note:** After setting, remember to click "Apply" and wait for the settings to be completed. The controller needs to be restarted for the settings to take effect after each setting.

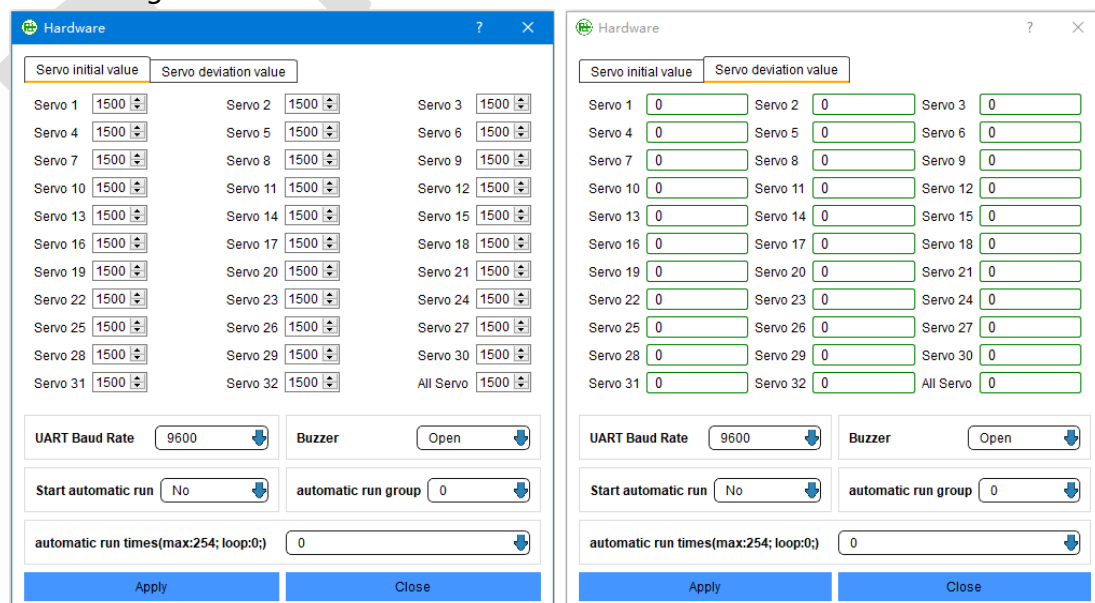




Figure 22

Figure 23

## IV. 3D Display Effect:

Click "Setting" -> "3D Virtual" to display the 3D effect interface.

**Note:** To display the 3D effect interface, you need to first select the control interface on the "Software" settings page and then open the serial port.

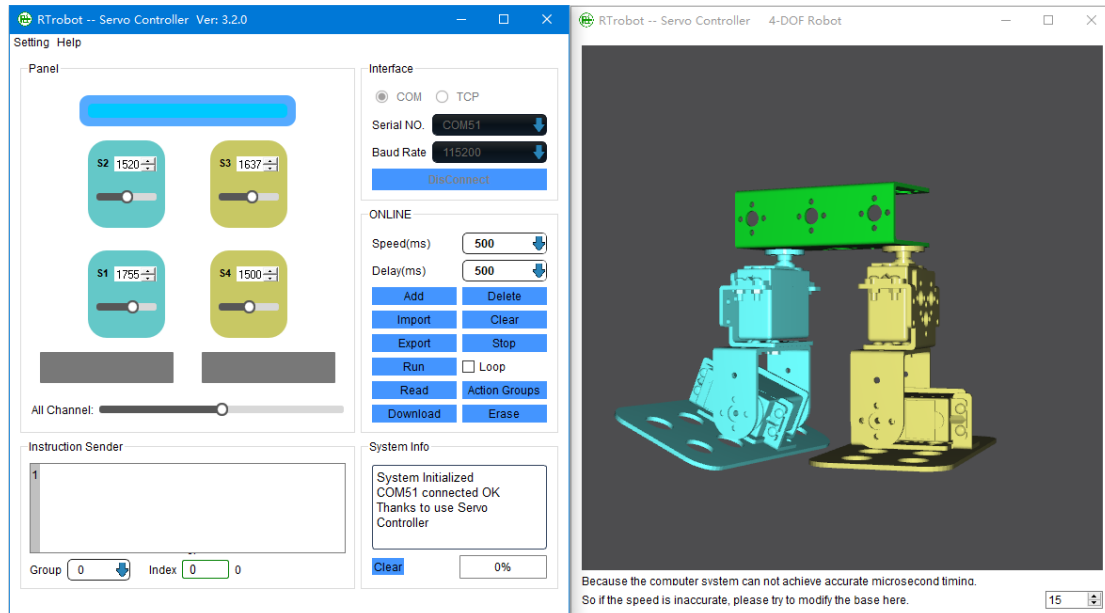


Figure 24

## V. Software Control:

1. Choose a suitable wiring method and connect it to the computer with a USB cable.
2. Open the "ServoController.exe" software.
3. Select the serial port and open it. If using WIFI mode, select TCP and enter the TCP address and port set by the WIFI module's TCP server.

**Note:** Only when connected to the computer with a USB cable can all functions be used.

### 1) Single servo motor operation:

As shown in **Figure 25**, the angle value of the servo motor can be changed by dragging or filling in the value.



Figure 25

### 2) Multiple servo motor operation:

As shown in **Figure 26**, first select the action group number to be edited in the "Group" selection box under the instruction information box, then set the first line of the operation value for each servo motor, and set the operating speed "Speed" and the delay time "Delay" after execution. Click "Add" to add, and then set the second line of the operation value for each servo motor and click "Add" to add. After all preset actions are set, click "Run" to test. If "Loop" is selected, it will run indefinitely.

Servo motor running speed "Speed": Complete the instruction within the specified time (cannot exceed the physical maximum speed of the servo motor).

Servo motor completion wait time "Delay": Delay the specified time after completing the current instruction before executing the next instruction.



Figure 26

### 3) Action instruction saving:

Click "**Export**" to save the action instruction to a text file for future import use.

**Note:** Here it is saved as instructions for all action groups.

### 4) Use file import operation:

Click "**Import**" to import previously saved action instructions into the software.

**Note:** Here it is imported as instructions for all action groups.

### 5) Action instruction editing:

Click on the instruction that needs to be edited in the instruction information box, right-click and select "Edit" or use the shortcut key "**Ctrl + E**" to edit.

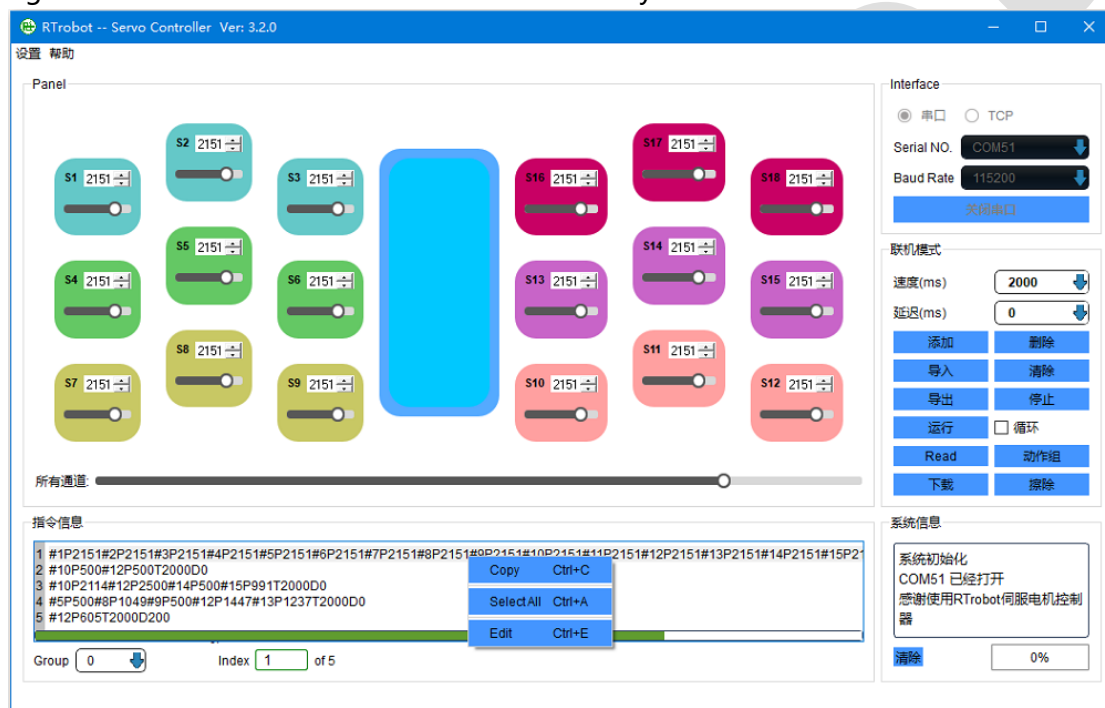


Figure 27

### 6) Offline operation:

After all instructions are edited, click "Download" to download the instructions for all action groups.

In the "**Setting**" -> "**Hardware**" interface, turn on the controller's automatic operation switch and select the action group number to be run.

### 7) Read instructions:

Click "**Read**" to read all instructions that have been downloaded to the controller.

## 8) Erase all action groups:

Click "[Erase](#)" to erase all instructions that have been downloaded to the controller. The erasing time is about 30 seconds.

## 9) Manual instruction editing:

Click "[Instruction](#)" to manually enter or edit instructions in the pop-up dialog box.



Figure 28

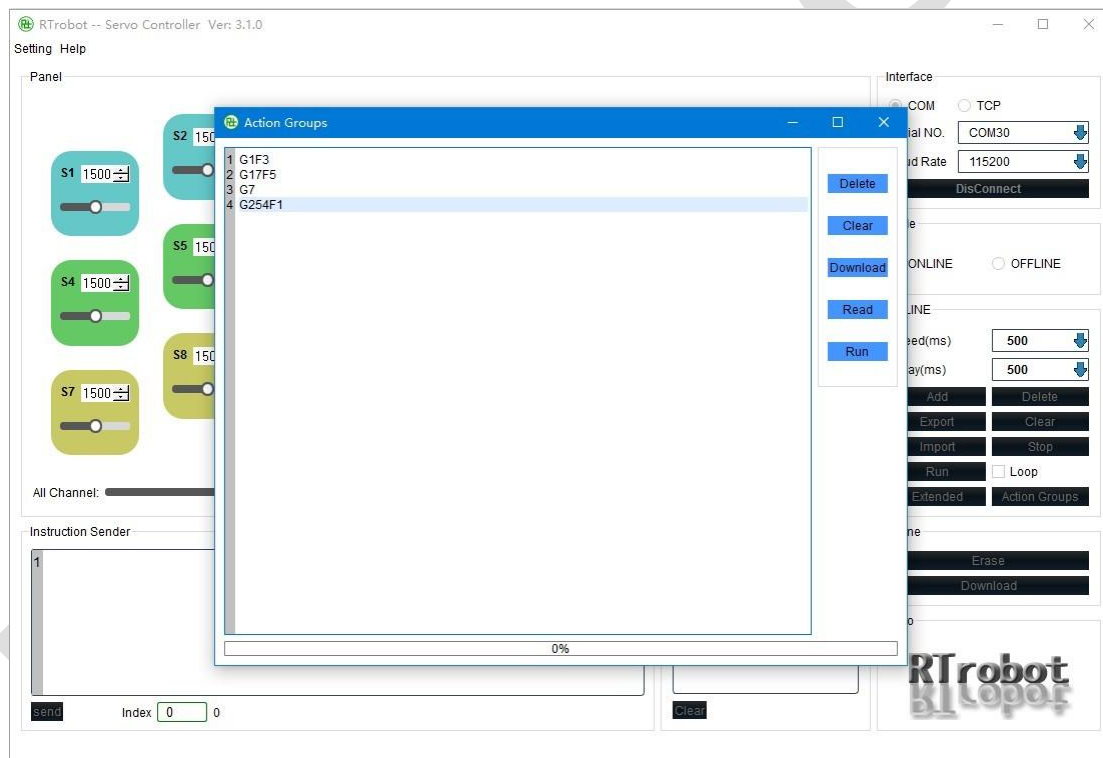
## VI. Action Group Editing:

Click "Action group" to open the action group running and editing window, as shown in **Figure 29**. Here, only the action group instructions can be edited, such as:

```
G1F3
G17F5
.....
```

G1 represents action group 1, and F3 represents running 3 times.

After editing is complete, you can click "Run" for testing. After successful testing, you can download and save it to the controller. When you open the software next time, you can use the "Read" function to read the previously downloaded action group instructions. If you need to run automatically, please change the automatic running switch to "Action Group Only" in the hardware settings.



**Figure 29**

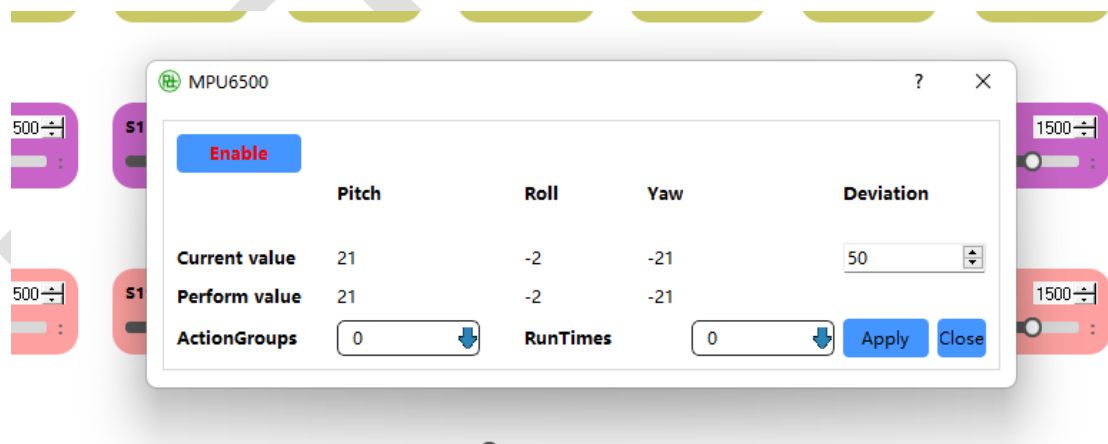
## VII. MPU6500

### (Only for 24-channel servo motor controller):

Click "Setting" -> "MPU6500" to open the MPU6500 setting interface, as shown in **Figure 30**. Click the "Disable" button to change the status to "Enable" to turn on the MPU6500. Pitch, Roll, and Yaw are the XYZ values of the MPU6500. After filling in the allowable deviation value, the action group and the number of runs to be performed when the values are exceeded, tilt the controller to trigger the running state and press the "Apply" button to make it effective and restart the controller. When the tilt direction of the controller reaches the set value, the previously set action group and the number of runs will be triggered and executed. (When debugging with the upper computer software by connecting to the computer via a USB cable, the MPU6500 will not be triggered.)

If the number of runs is set to "0", it will not be triggered, and only the MPU6500 value will be fed back through the serial port.

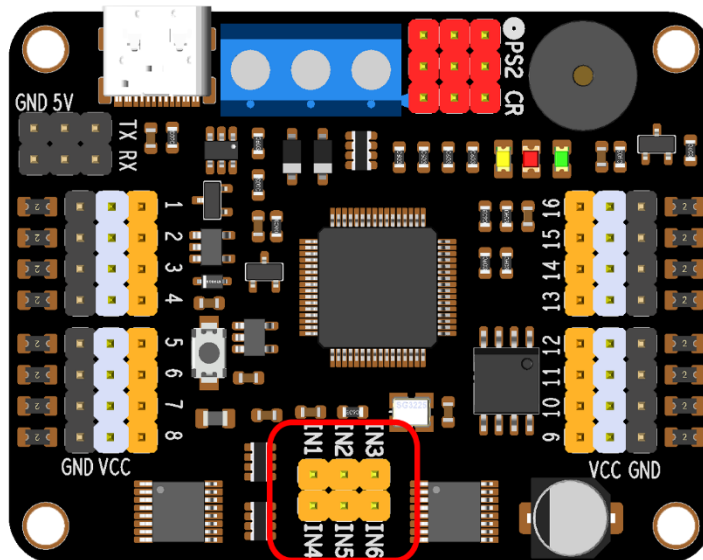
21	,	-2	,	-21	\r	\n
0X32 0X31	0X2C	0X2D 0X32	0X2C	0X2D 0X32 0X31	0X0D	0X0A
Pitch	,	Roll	,	Yaw	\r	\n



**Figure 30**

**Note:** Before executing the action group, the serial port will first feedback "TRIGGER", and after executing the specified action group, it will feedback "OK".

## VIII. 6-channel digital level sensor interface (Only available on the 16-channel servo motor controller):



*Figure 31*

The six digital level sensor interfaces highlighted in the red circle of **Figure 31** can independently control six action groups or maintain the current position of designated servo motors., which can independently control six action groups or maintain the current position of specified servo motors (**only supports 3.3/5V digital level sensors**).

If using the USB cable to connect to a computer and debugging with the upper computer software, the external sensor will not trigger.

**Note:** The GND of each sensor needs to be connected to the GND of the controller. When multiple INs are triggered at the same time, the one with the lower sequence number is effective;

**IN1 > IN2 > IN3 > IN4 > IN5 > IN6**

Example 1: IN2 and IN3 are triggered at the same time, only the action group specified by IN2 will be executed. If IN2 is released and IN3 is still triggered, the action group specified by IN3 will be executed.



Example 2: IN1 triggers the execution of an action group, while IN6 maintains the current position of a servo motor. When both are triggered at the same time, they do not affect each other, and both IN1 and IN6 are effective.

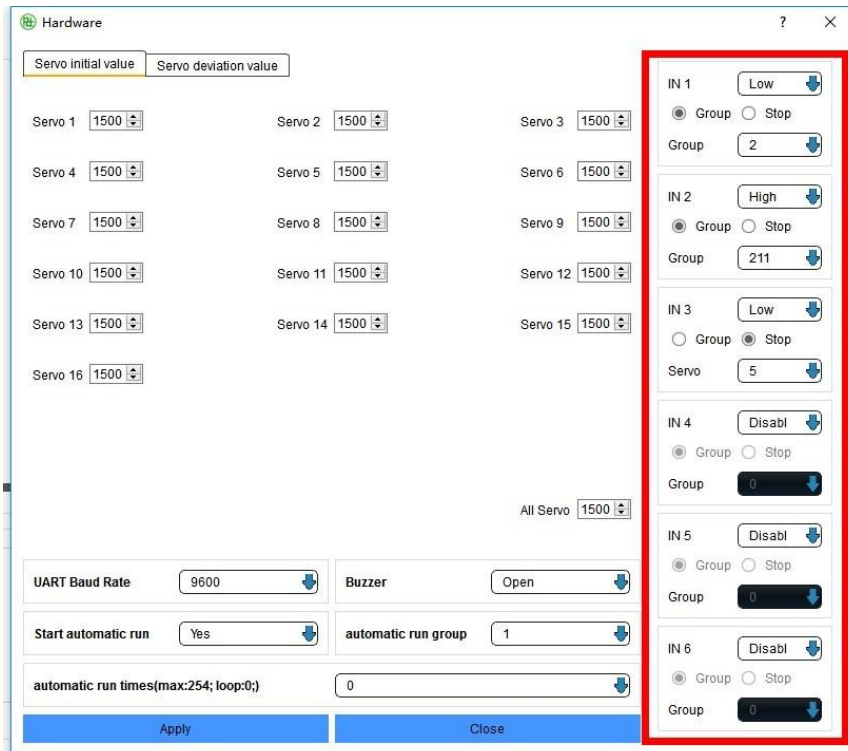


Figure 32

INx three options:

- Disable: Off (Trigger is invalid)
- High: Trigger on high-level signal
- Low: Trigger on low-level signal

**Group:** Action group executed after triggering.

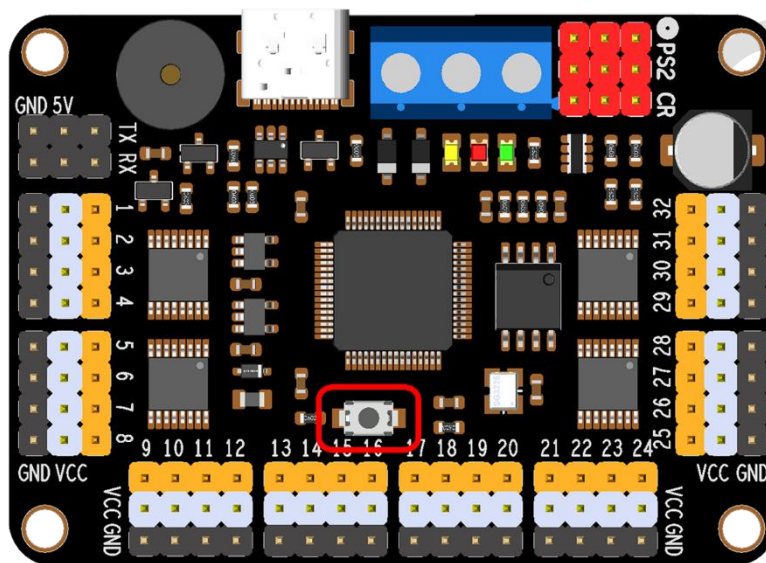
**Stop:** Stop the servo motor after triggering and maintain the current position.

**Note:** Before executing the action group, the serial port will first provide feedback "TRIGGER", and after completing the specified action group, it will provide feedback "OK".

**Note:** AC level sensors are invalid.

## IX. Firmware upgrade method:

1. Download the latest PC software from "<http://www.rtrobot.org/software>" website.
2. Open the latest version PC software.
3. Hold down the button on the servo motor controller while connecting the USB data cable, and then release the button.

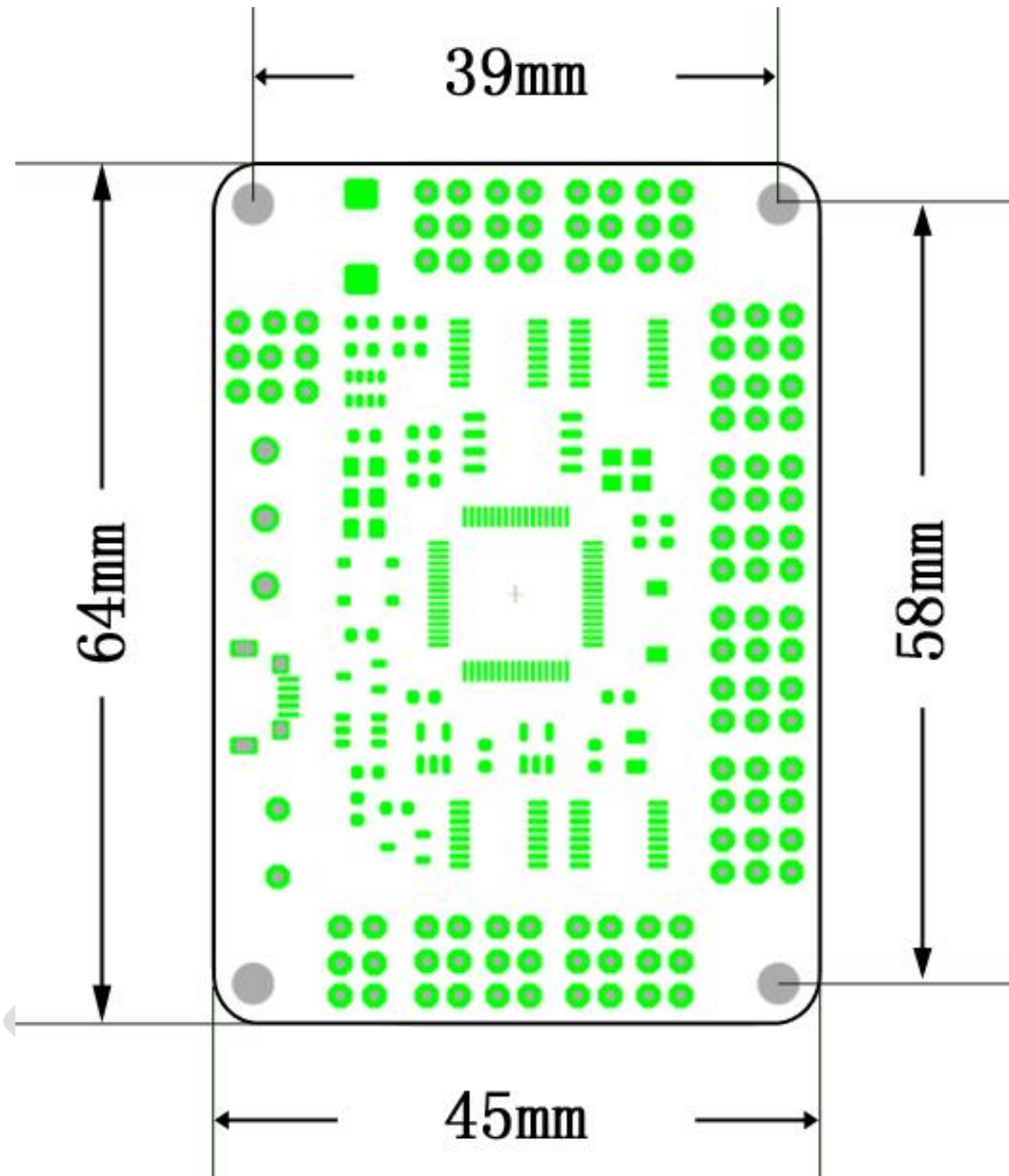


*Figure 33*

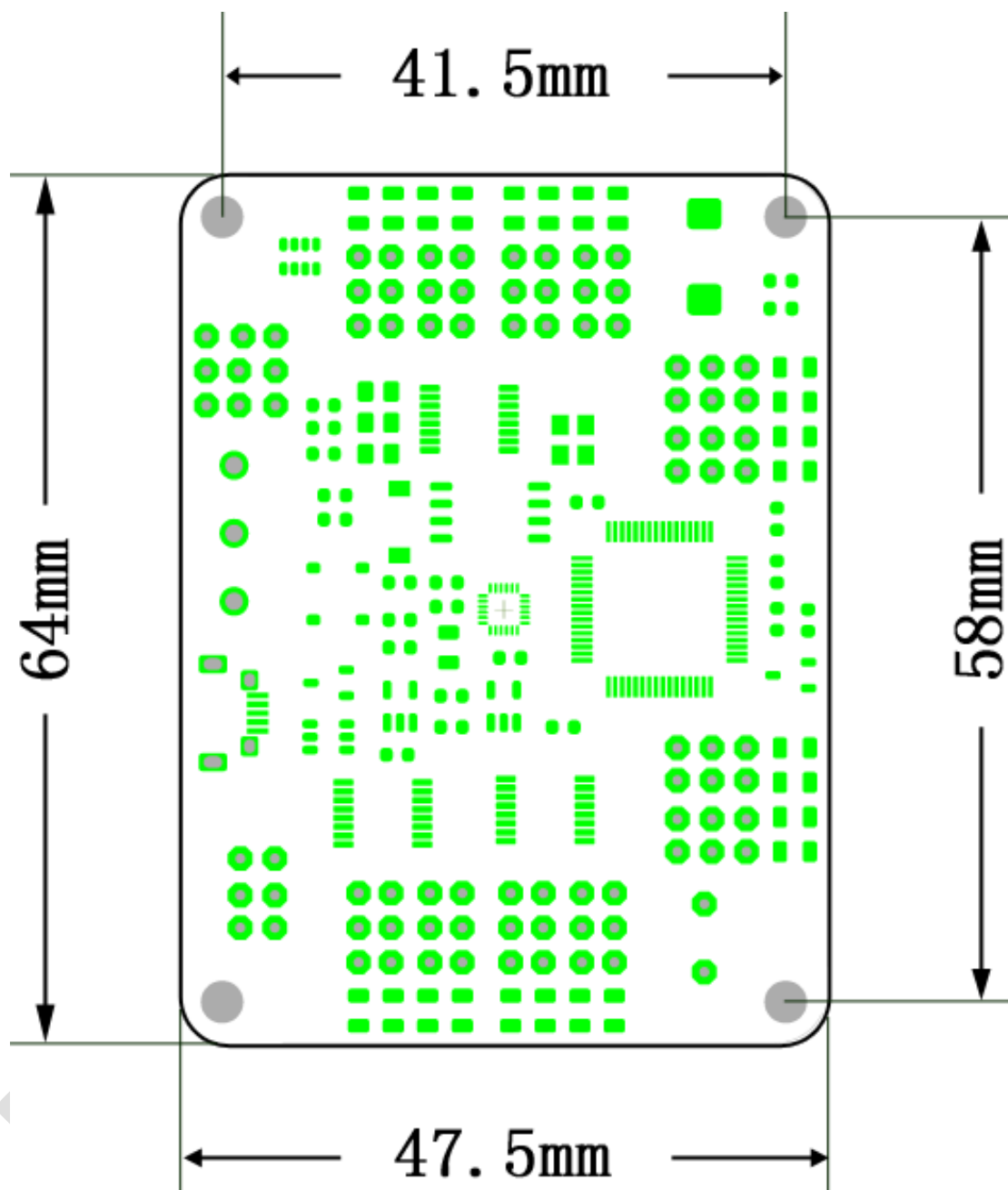
4. Open the serial port in the latest PC software. The firmware will start to upgrade. After the upgrade is complete, a message will be displayed: "Update Success, Restart the controller, please."
5. Restart the servo motor controller
6. If the firmware is already up to date, the message "ERROR Don't need update!" will be displayed.

## Dimensional drawing:

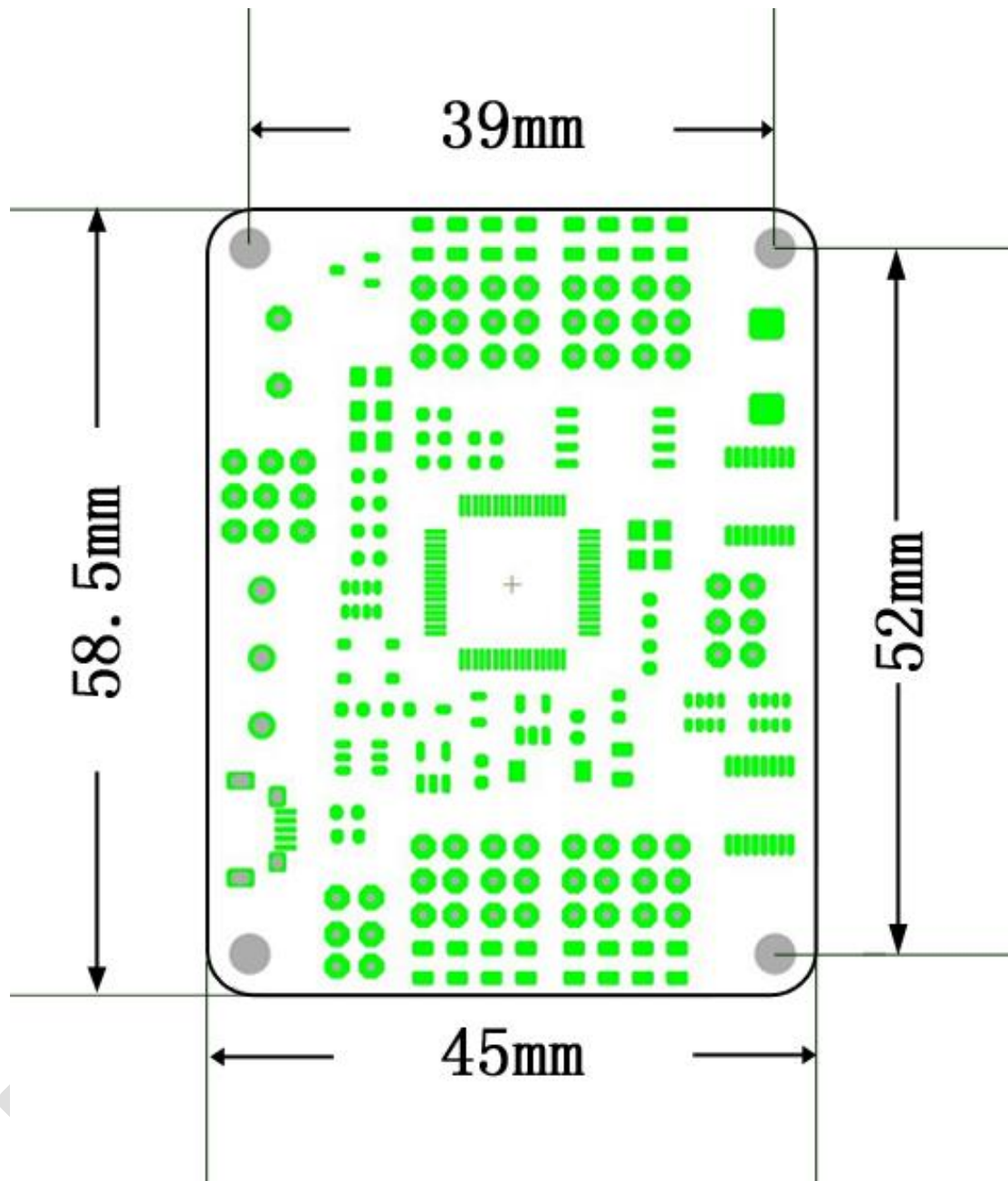
32:



24:



16:



## X. About

Thank you for using the servo motor controller produced by RTrobot. If you have any questions about the controller during use and need to consult, you can email us at [admin@rrobot.org](mailto:admin@rrobot.org).