

3.3 PC Control Routine

The document demonstrates the control of MaxArm's bus servo angles, setting of XYZ coordinates, control of nozzle functionality, and reading of bus servo angles and XYZ coordinates using an Arduino controller.

1. Working Principle

- 1) After MaxArm is serially connected to TTL, and then connected to a PC for serial communication, enabling serial control of MaxArm through the serial port.
- 2) Communication protocol:

Following uses communication protocols as examples. The format of the protocol instruction packet is as follow:

Frame header	Function code	Data length	Data information	Check bit
0xAA 0x55	func	len	data	check

Frame header: if 0xAA and 0x55 are received sequentially, it indicates that there is data to be received, consisting of a fixed 2 bytes.

Function code: Used to indicate the purpose of a message frame.

Data length: Indicates the amounts of the consequent data

Data information: indicate the transmission data information.

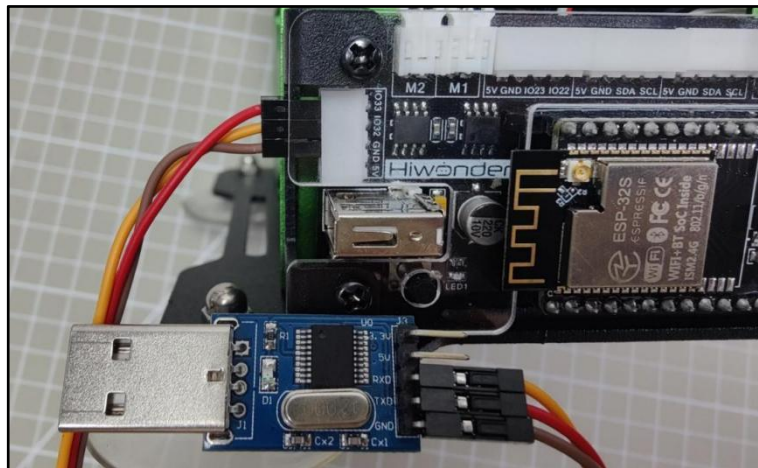
Checksum: The checksum is calculated by taking the complement of the sum of the Function Code, Data Length, and Data, and then taking the lower byte.

2. Preparation

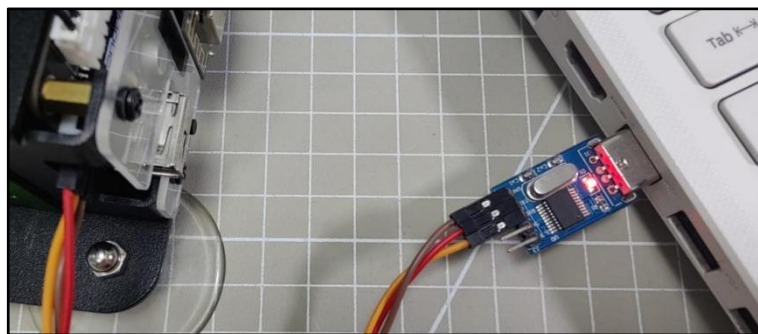
2.1 Hardware

Please make sure to properly connect MaxArm robotic arm to PC, otherwise, it will affect the normal communication.

- 1) Connect the RXD, TXD, and GND pins of the USB adapter to the IO32, IO33, and GND interfaces of the ESP32 expansion board, respectively, using Dupond wires.

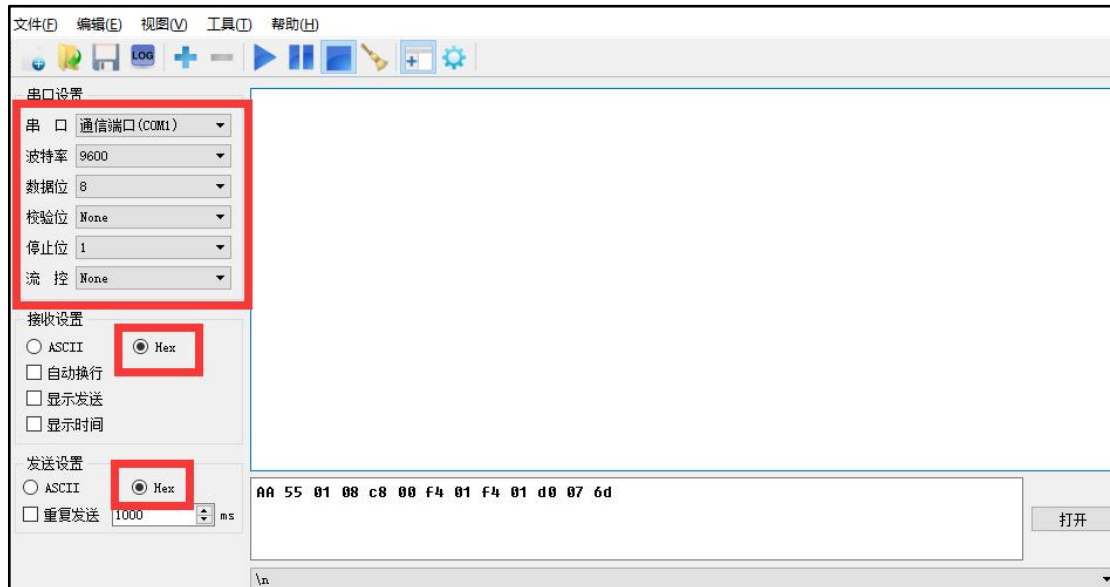


- 2) Connect the USB adapter to the computer.



2.2 Software

Please ensure that the baud rate of the serial port assistant is set to 9600, parity is set to NONE, data bits are set to 8, stop bits are set to 1, and hexadecimal sending is selected, as shown in the configuration below:



3. Project Outcome

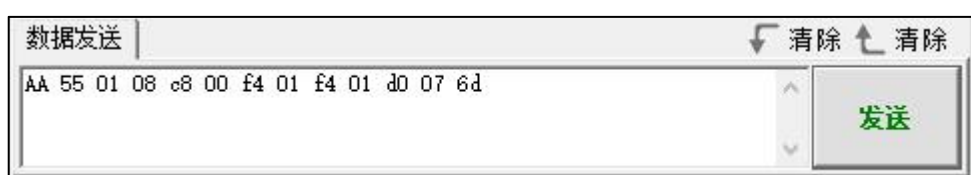
Control MaxArm by sending hexadecimal commands:

Command name: FUNC_SET_ANGLE, command value 0x01, data length 8:

Description: Controls the rotation of the bus servos of MaxArm

Data information: First, set the angles of the three bus servos, followed by the servo's operating time, totaling 4 values. Each value is split into 2 bytes, with the low byte first and the high byte last.

Example: Taking the hexadecimal sequence AA 55 01 08 c8 00 f4 01 f4 01 d0 07 6d as an example, the data information is c8 00 f4 01 f4 01 d0 07. Among them, c8 00 represents servo 1 rotating to position 200, the following two f4 01 correspond to servo 2 and 3 rotating to position 500 respectively, and d0 07 indicates the operating time is 2000ms.



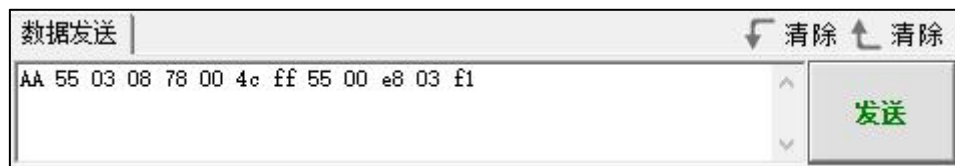
Command Name: FUNC_SET_XYZ, command value 0x03, data

length 8:

Description: Controls the XYZ coordinates of MaxArm.

Data Information: First are the coordinates corresponding to XYZ, followed by the operating time, totaling 4 values. Each value is split into 2 bytes, with the low byte first and the high byte last.

Example: Taking the hexadecimal sequence AA 55 03 08 78 00 4c ff 55 00 e8 03 f1 as an example, the data information is 78 00 4c ff 55 00 e8 03. Among them, 78 00 represents X coordinate as 120, 4c ff represents Y coordinate as -180, 55 00 represents Z coordinate as 85, and e8 03 represents the operating time as 1000ms.



Command Name: FUNC_SET_PWMSE servo, command value 0x05, data length 4:

Description: Controls the rotation of the PWM servo.

Data Information: There are 2 parameters in total. The first parameter is the angle of rotation for the PWM servo, followed by the operating time, totaling 2 values. Each value is split into 2 bytes, with the low byte first and the high byte last.

Example: Taking the hexadecimal sequence AA 55 05 04 D0 07 e8 03 34 as an example, the data information is D0 07 e8 03. Among them, D0 07 represents the servo rotating to position 2000, and e8 03 represents the operating time as 1000ms.

数据发送	<div style="border: 1px solid black; padding: 2px;">AA 55 05 04 D0 07 e8 03 34</div>	<div style="display: flex; justify-content: space-between;"> ↓ 清除 ↑ 清除 </div>
<div style="border: 1px solid black; height: 40px; margin-bottom: 2px;"></div>		<div style="border: 1px solid black; padding: 5px; width: 50px; margin: 0 auto; background-color: #f0f0f0;">发送</div>

Command Name: FUNC_SET_SUCTIONNOZZLE, command value 0x07, data length 1:

Description: Controls the suction nozzle function.

Data Information: 1 indicates turning on the vacuum pump, 2 indicates turning off the vacuum pump and opening the air valve, 3 indicates closing the air valve.

Example: Taking the hexadecimal sequence AA 55 07 01 02 f6 as an example, the data information is 02, which indicates that the suction nozzle will perform the operation of turning off the air pump and opening the air valve.

数据发送	<div style="border: 1px solid black; padding: 2px;">AA 55 07 01 02 f6</div>	<div style="display: flex; justify-content: space-between;"> ↓ 清除 ↑ 清除 </div>
<div style="border: 1px solid black; height: 40px; margin-bottom: 2px;"></div>		<div style="border: 1px solid black; padding: 5px; width: 50px; margin: 0 auto; background-color: #f0f0f0;">发送</div>

Command Name: FUNC_READ_ANGLE, command value 0x11, data length 0:

Description: Reads the current angles of the bus servos on MaxArm.

Data Information: Since it is a read operation, there is no data information.

Example: Taking the hexadecimal sequence AA 55 11 00 EE as an example.

数据发送	<div style="border: 1px solid black; padding: 2px;">AA 55 11 00 EE</div>	<div style="display: flex; justify-content: space-between;"> ↓ 清除 ↑ 清除 </div>
<div style="border: 1px solid black; height: 40px; margin-bottom: 2px;"></div>		<div style="border: 1px solid black; padding: 5px; width: 50px; margin: 0 auto; background-color: #f0f0f0;">发送</div>

After sending the data, MaxArm returns the current angles of the three bus servos. Taking the received data AA 55 11 06 60 03 9A 01 C9 02 20 as an example, the data information is 60 03 9A 01 C9 02. Here, 60 03 represents the current position of servo 1 as 873, 9A 01 represents the current position of servo 2 as 410, and C9 02 represents the current position of servo 3 as 713.



Instruction Name: FUNC_READ_XYZ, command value 0x13, data length 0:

Description: Reads the current XYZ coordinates of MaxArm.

Data Information: Since it is a read operation, there is no data information.

Example: Taking the hexadecimal sequence AA 55 13 00 EC as an example.



After sending the data, MaxArm returns the current XYZ coordinates. Taking the received data AA 55 13 06 61 FF FA FF 60 00 2E as an example, the data information is 61 FF FA FF 60 00. Here, 61 FF represents the X-axis as -159, FA FF represents the Y-axis as -6, and 60 00 represents the Z-axis as 96.

