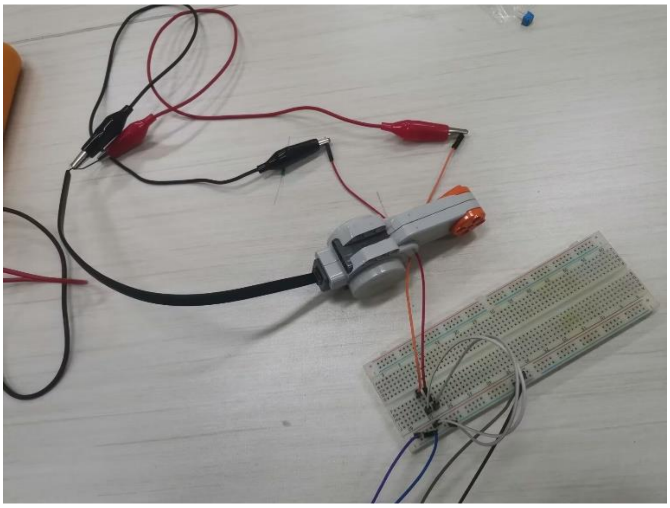
Step1



$$V_{min} = 0.53V$$

In actual measurement, we found that Vmin is 0.2 higher than voltage dropped from high to low. We took a smaller value.

Step2

$$r_m = 10.2\Omega$$

Step3

$$V_{motor} = 0.01V$$

Check Yourself 1.

The motor is not running. $V_{motor} < V_{min}$, V_{motor} **is short of the minimum voltage required to make the motor turn.**

Step4

$$V_{motor} = 0.01V$$

The unturned motor corresponds to the pure resistance in a circuit.

$$\mathrm{rm}//\mathrm{R2} \approx 10.2\Omega$$

$$V_{R1} \approx 9.899V$$

Because of the disparity between 10.2Ωand 1000Ω, almost all voltage was added into R1.

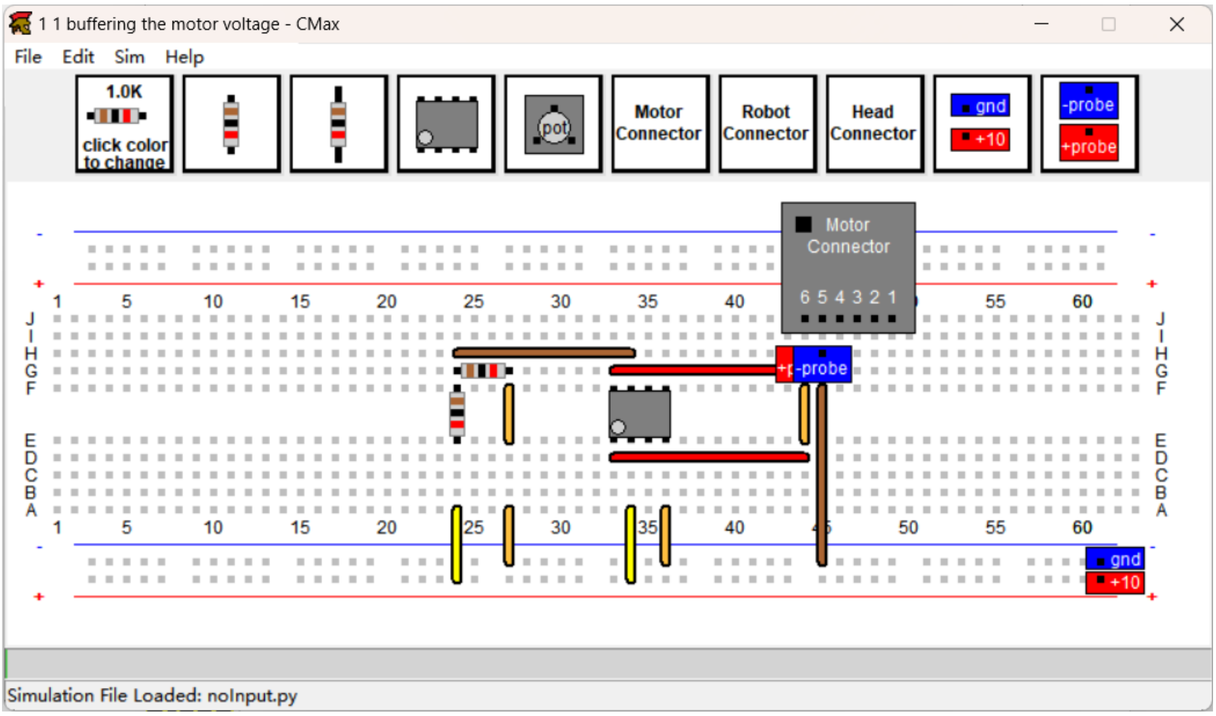
Check Yourself 2.

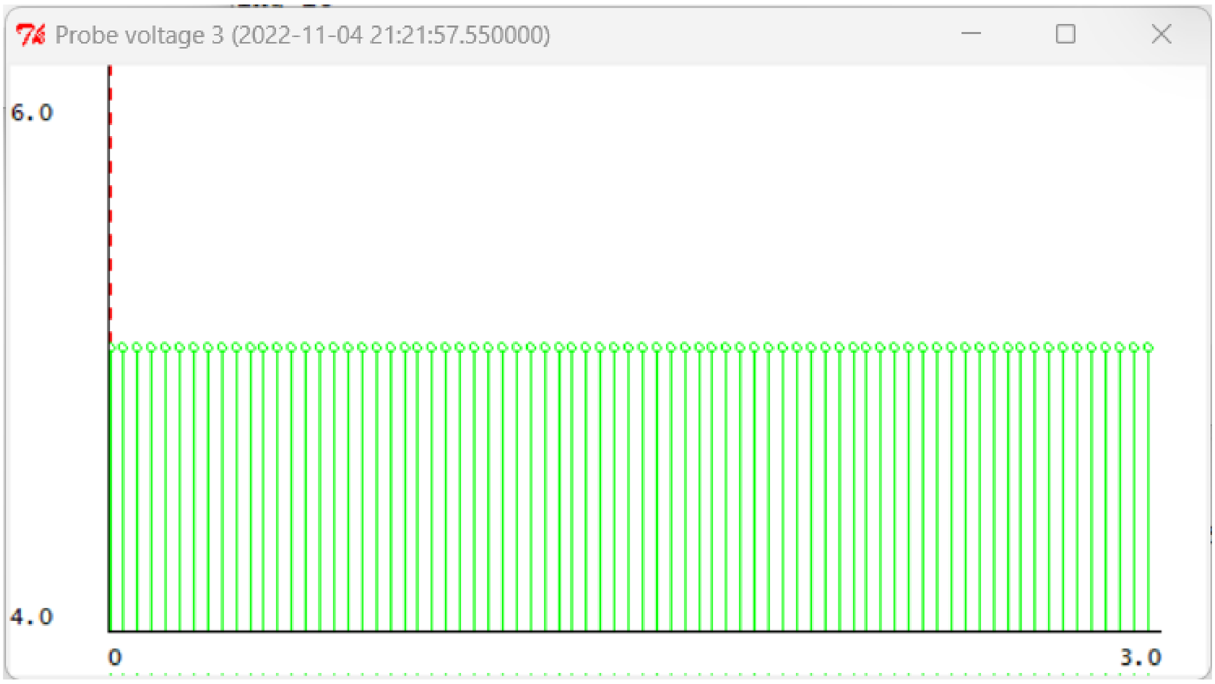
The theory matched the measurement in the previous part.No

counter electromotive force is generated when the motor is not turned.

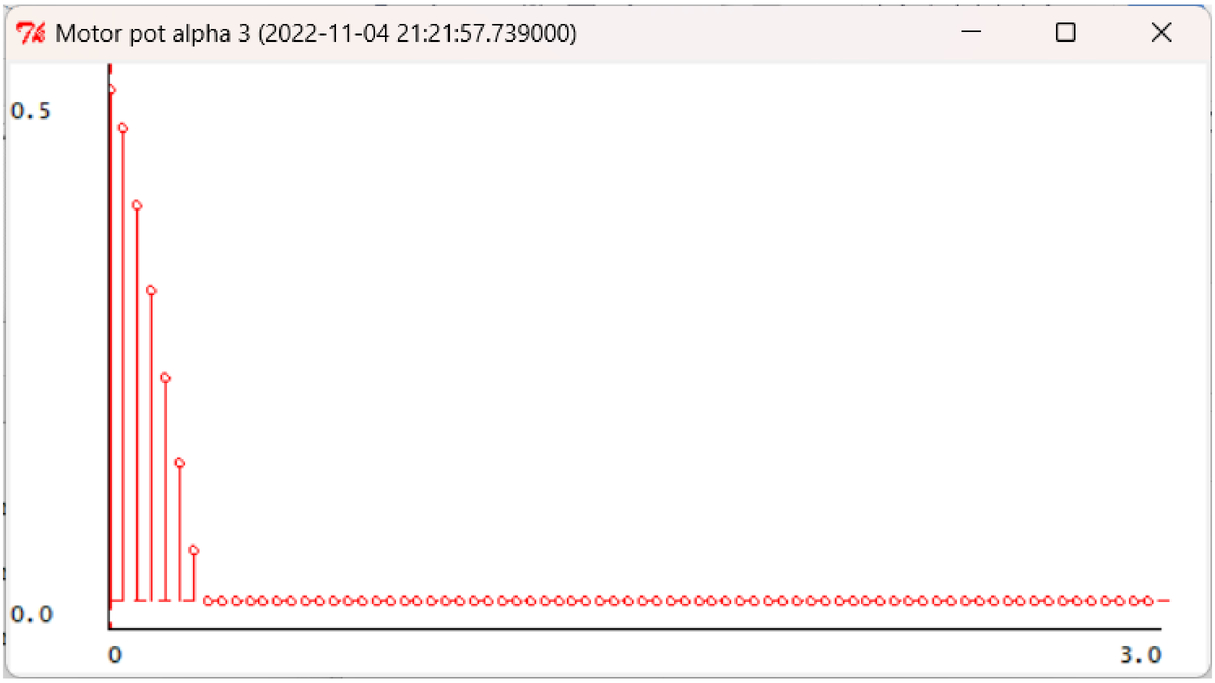
Step5

buffered divider circuit:





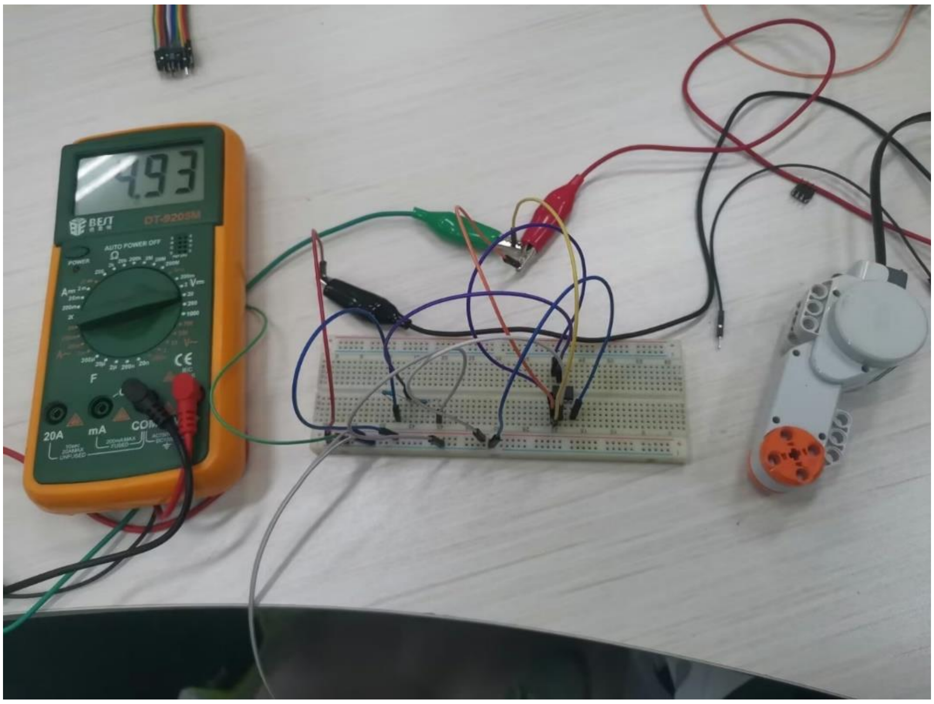
volltage of pin 5-6



Motor pot alpha

Moto rotational velocity

Step6



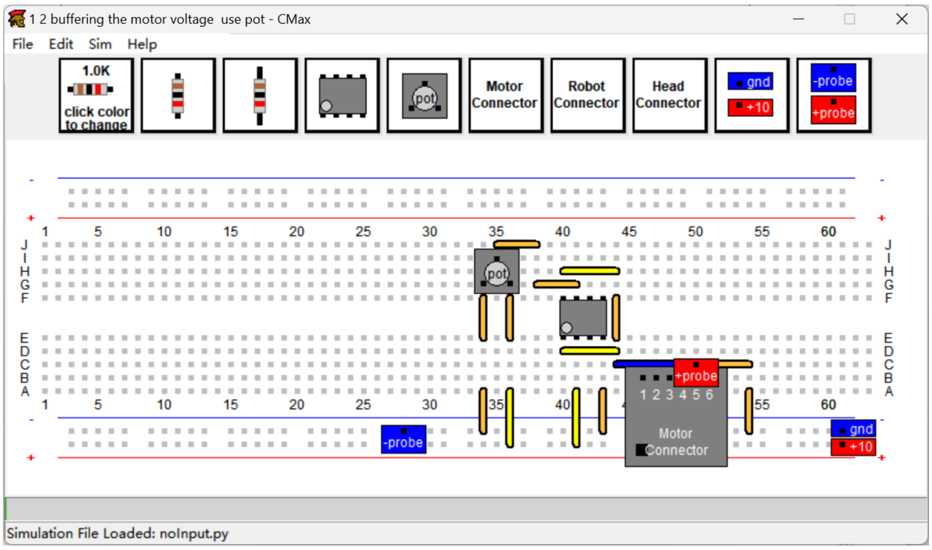
$$V_M = 4.93V$$

Motor functions well

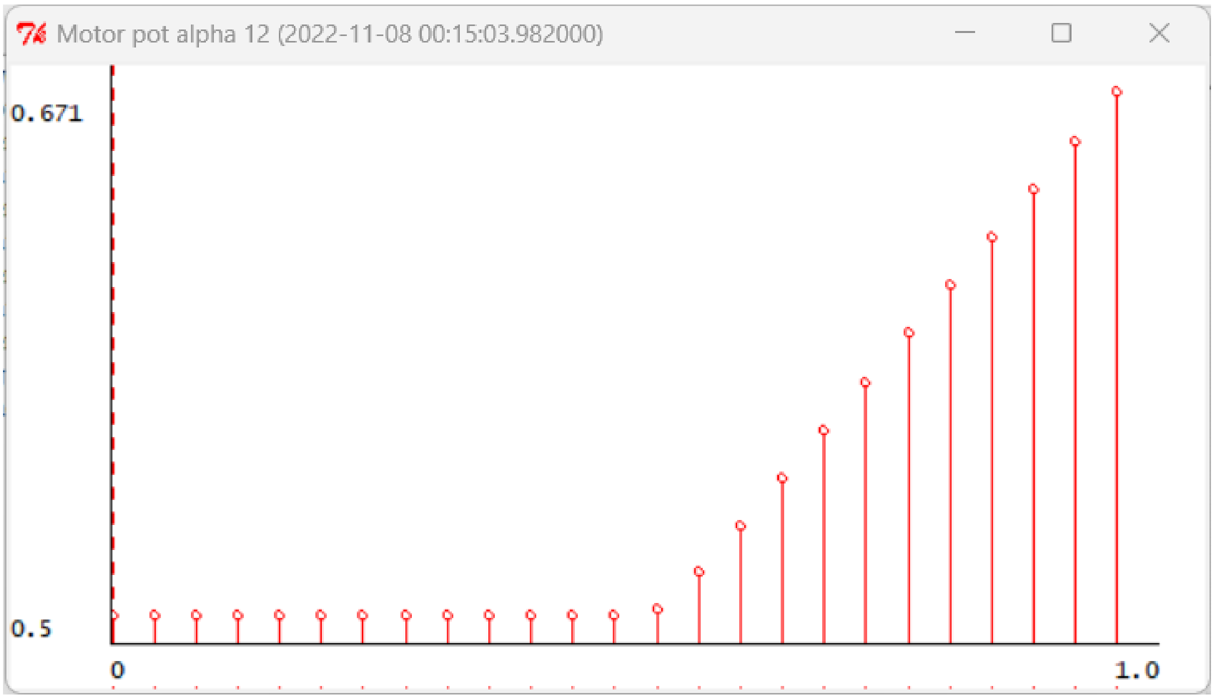
Check Yourself 3.

Buffered divider circuit created isolation between motor and basic circuit.It is a good way to get a special point volatge. Equivalent to output a new voltage source. 5V≈4.93V>0.53V Enough to drive the motor.

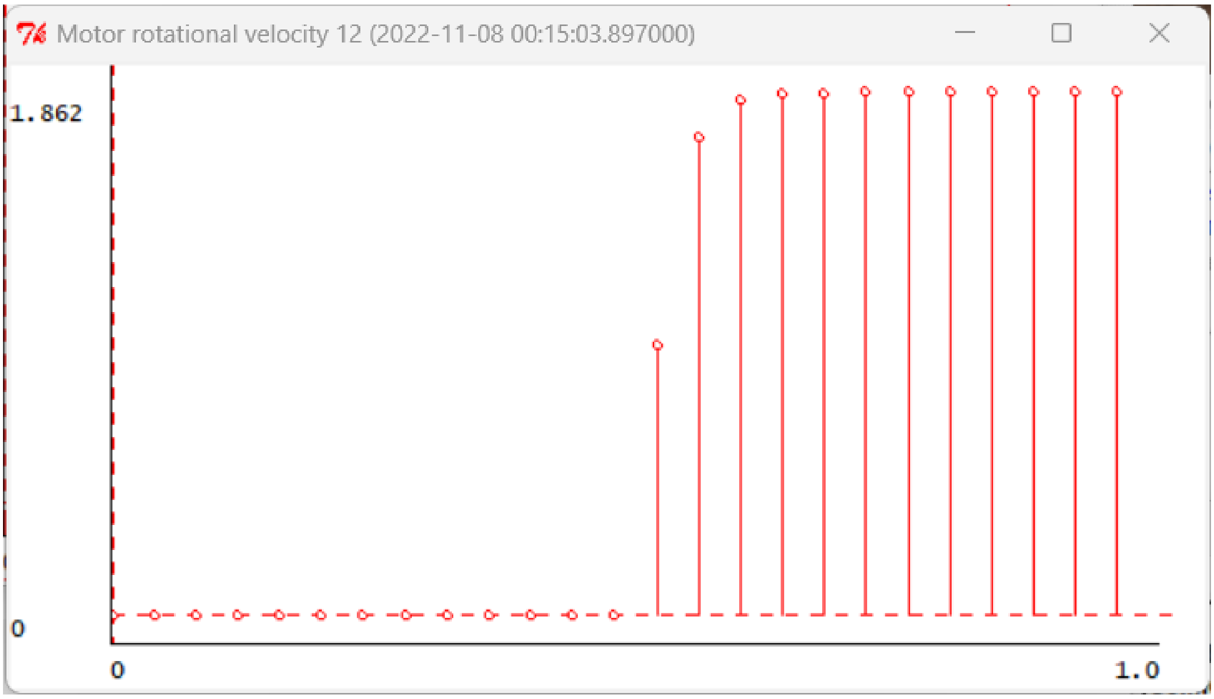
Step7



Check Yourself 4.



Motor pot alpha



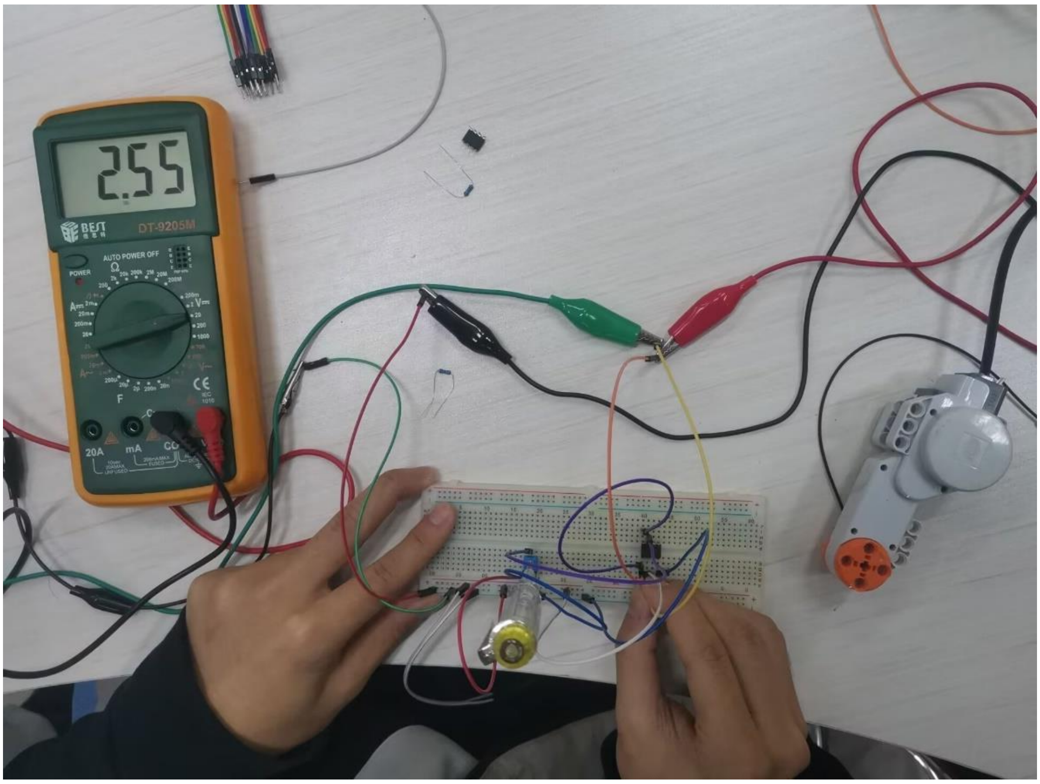
Motor rotational velocity

In the first half of this graph,$v_m = 0$**, the corresponding voltage is 0(**$\alpha = 0$**)**

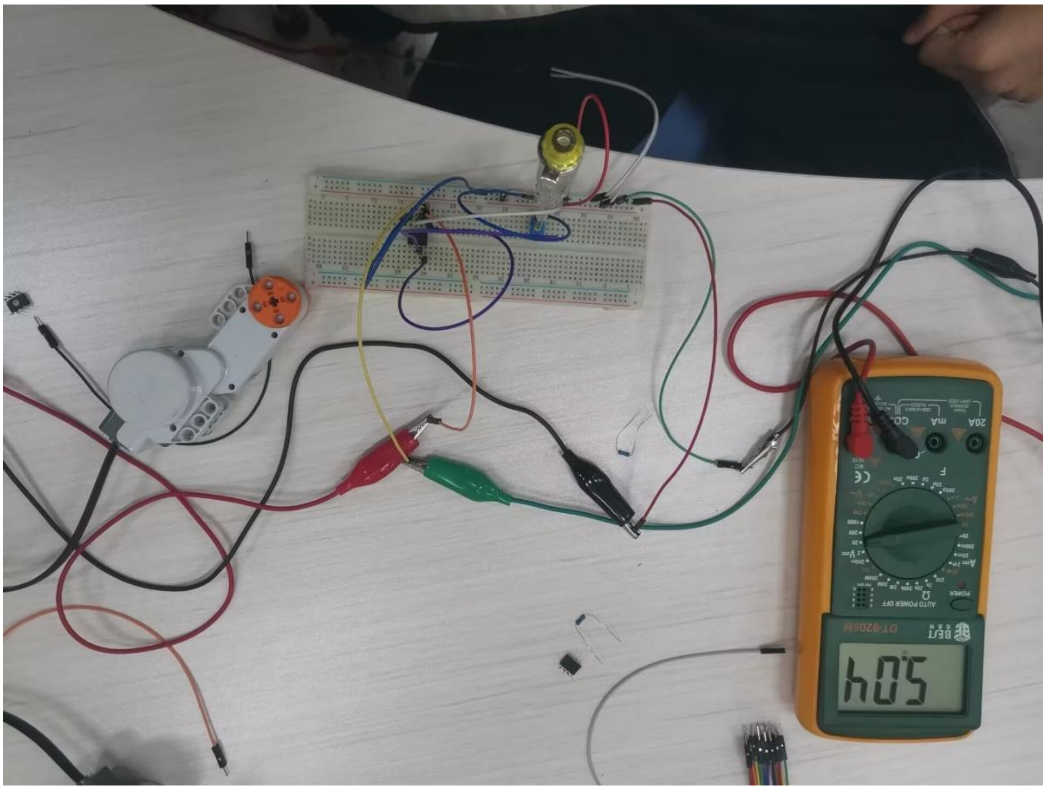
In the second half of this graph, v_m **gradually increase to a fixed value, the velocity of the motor is constant after buffering for a**

certain time($\alpha = 0.1$)

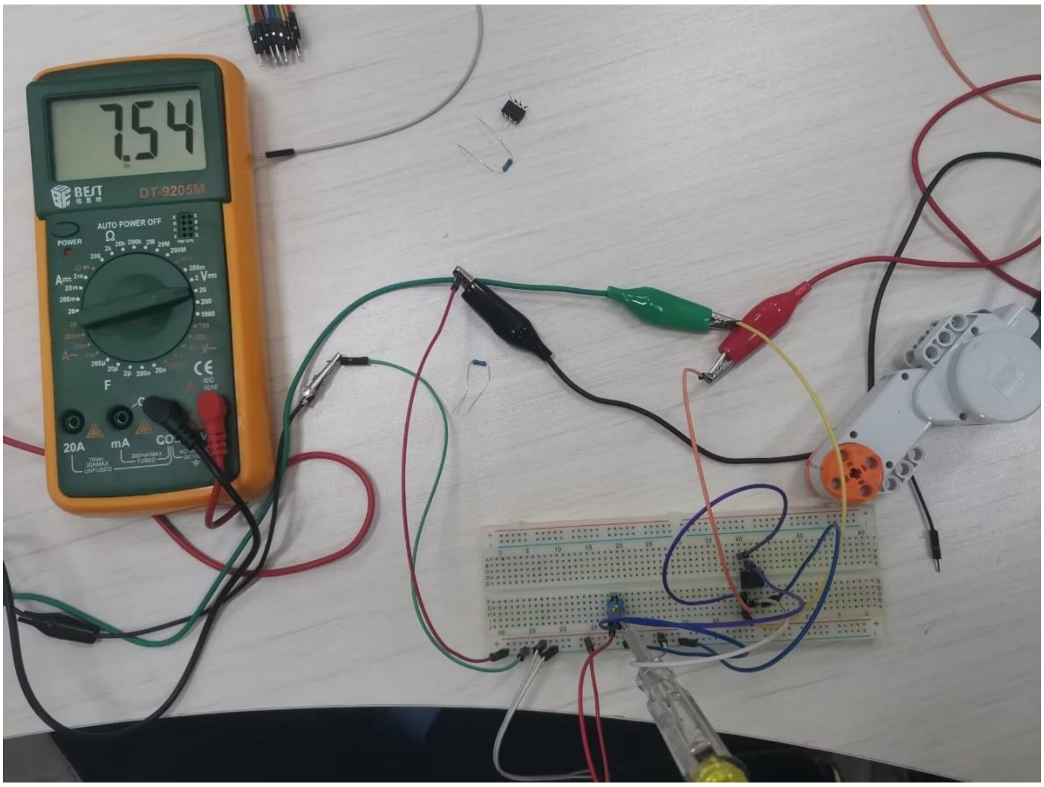
Step8



1/4 turn



1/2 turn

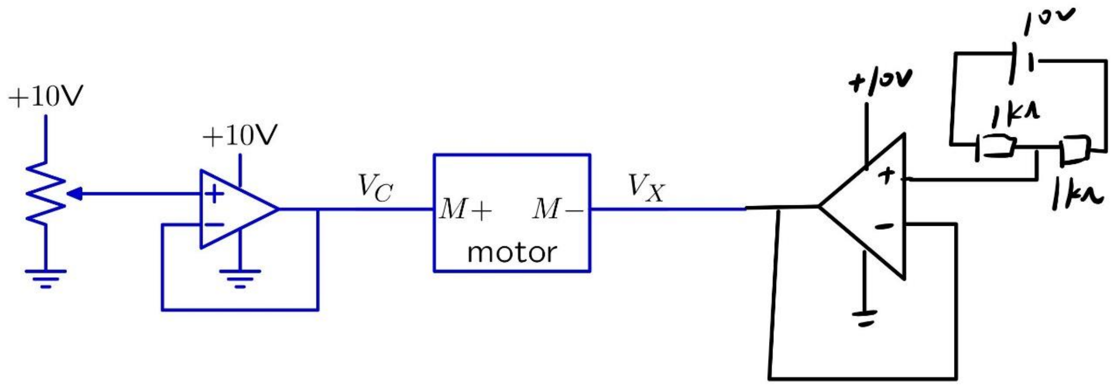


3/4 turn

In actual measurement, motor rotational velocity quickly stabilized. The voltage value reflected the motor rotational velocity.

Step9

$$V_X = 5V$$

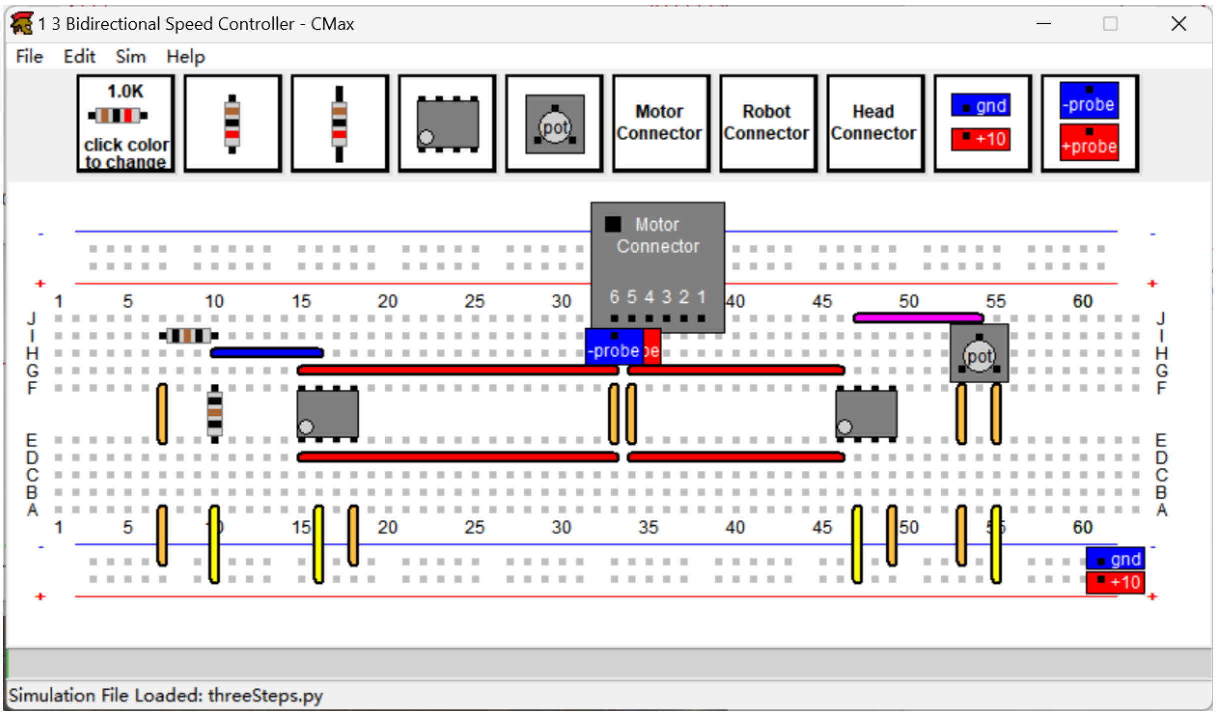


Check Yourself 5.

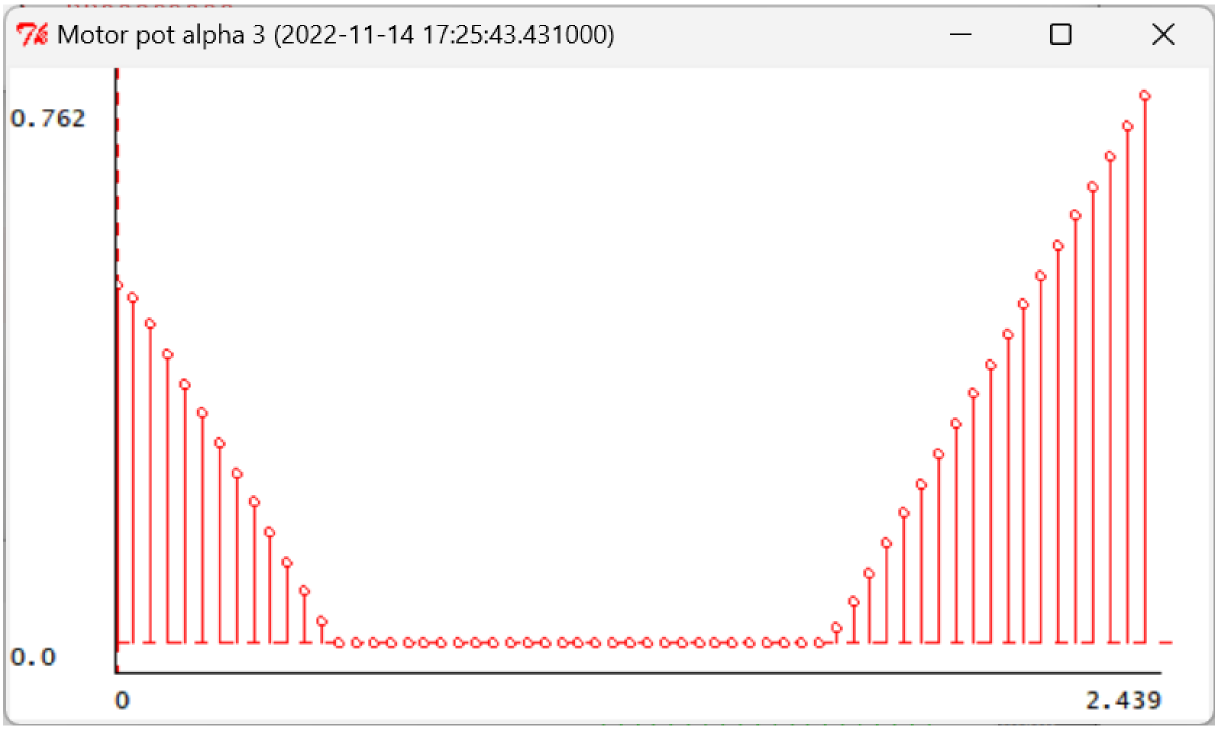
We take a 5V node from a 10V node in a simple circuit. It is directly connected to the motor using the buffer.

Step10

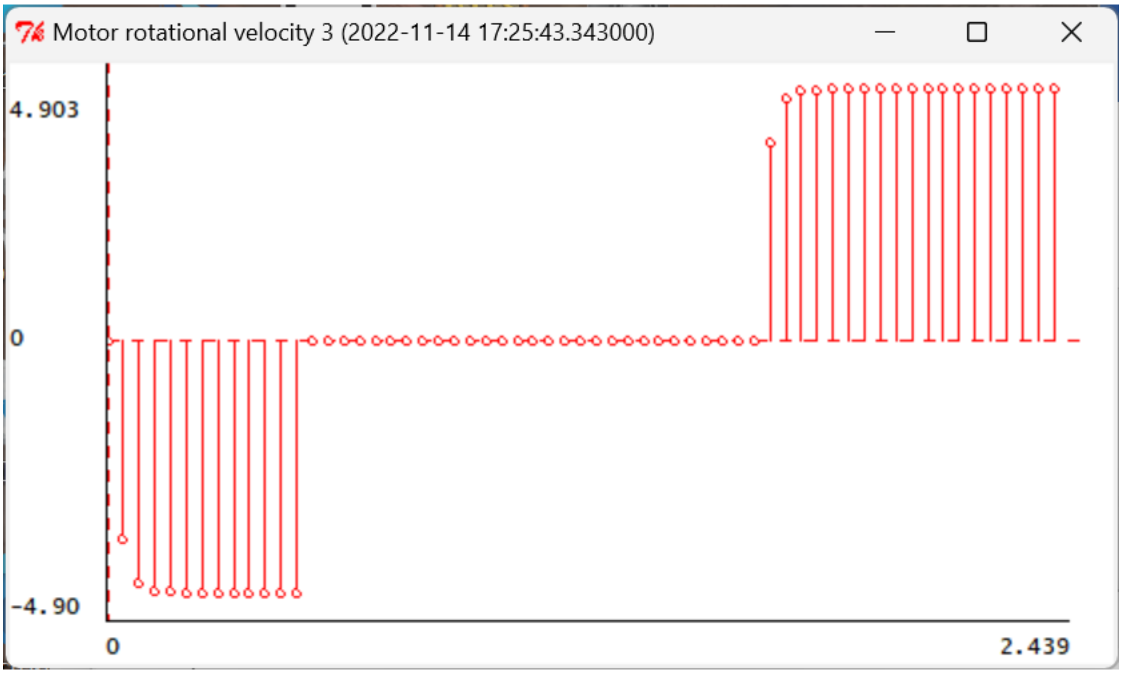
Bidirectional Speed Controller circuit in CMax:



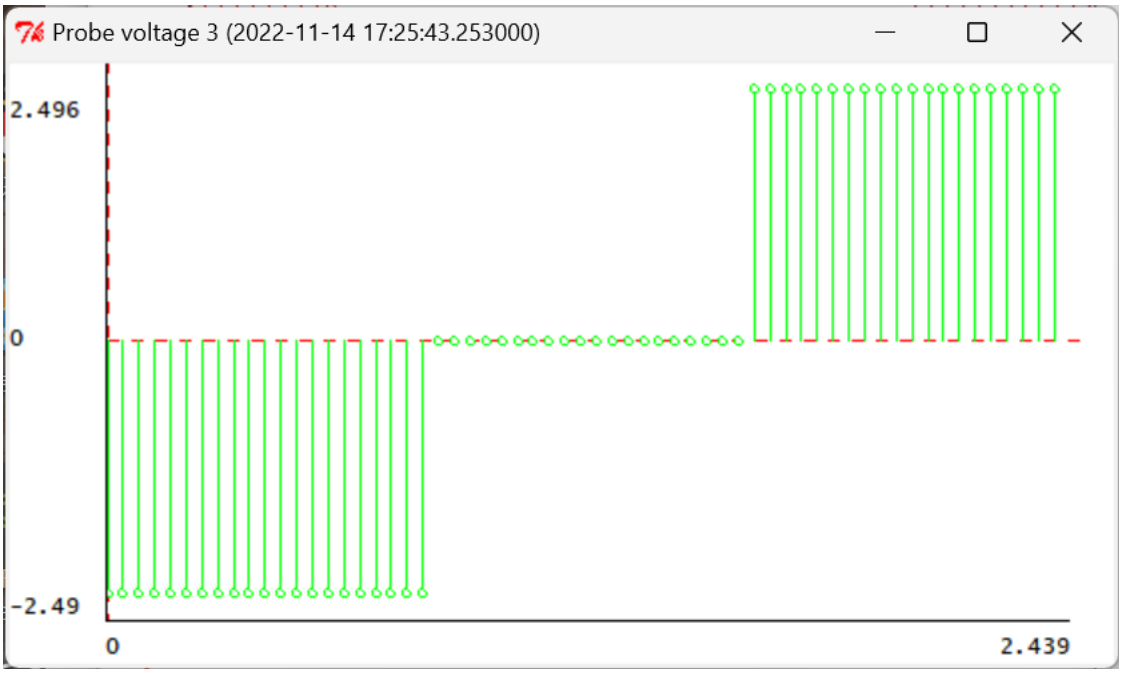
Checkoff 2.



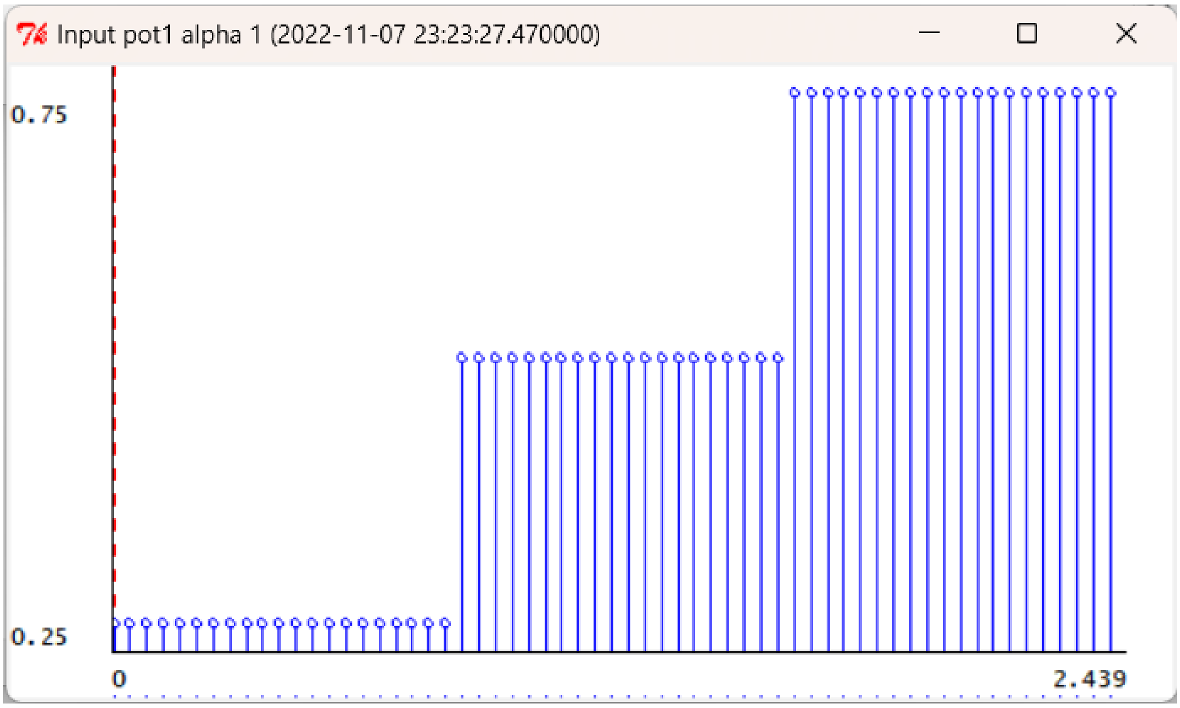
Motor pot alpha



Motor rotational velocity



V_M



Plus or minus of V_M(V5-V6) is relative to motor rotational velocity.

When $\alpha = 0.25$,$V_M += 2.5V$, $V_M \approx -2.5V$,the motor rotates inversely.

When $\alpha = 0.50$,$V_M += 5V$, $V_M \approx 0V$, motor rotational velocity=0.

When $\alpha = 0.75$,$V_M += 7.5V$, $V_M \approx 2.5V$,the motor rotates normally.

We fixed Vm- to 5v, so that the whole circuit has an up-floating voltage in advance, so that when Vm+ changes from 0 to 10V, we can still obtain the corresponding negative voltage, to realize the motor reversal.

Summary

1. **Buffering the voltage：To extract the voltage value at a point in the basic circuit without exposing it to the influence of other circuits。We can add an op amp to buffer the output of the resistor network.**
2. **Bidirectional controller：We can introduce a constant potential similar to ground as a comparison value at one end of the target position. When we cannot directly input negative voltage, we can consider comparing the voltage difference between the input end and the constant value to complete the target.**