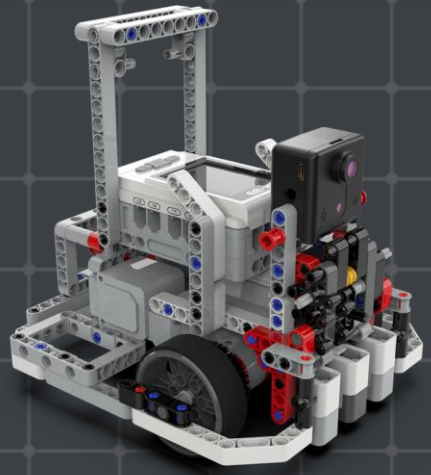


Lesson 21 | Oil Pumping Unit |

Key points from this lesson:

1. Learn about the motor encoder and encoder value

2. Learn to write programs that use encoder values to control devices

Possible difficulties from this lesson:

1. Be familiar with the difference between positive and negative encoder values

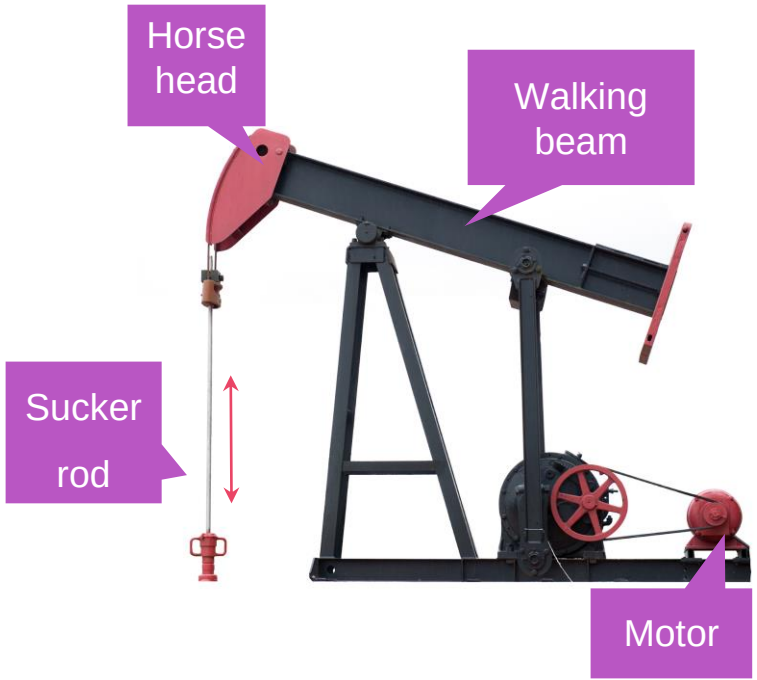
Oil Pumping Unit

Oil is one of the most important energy resources in the world. It is widely used in power generation, transportation, heating, and industrial production. The oil pump is a machine used to extract oil.





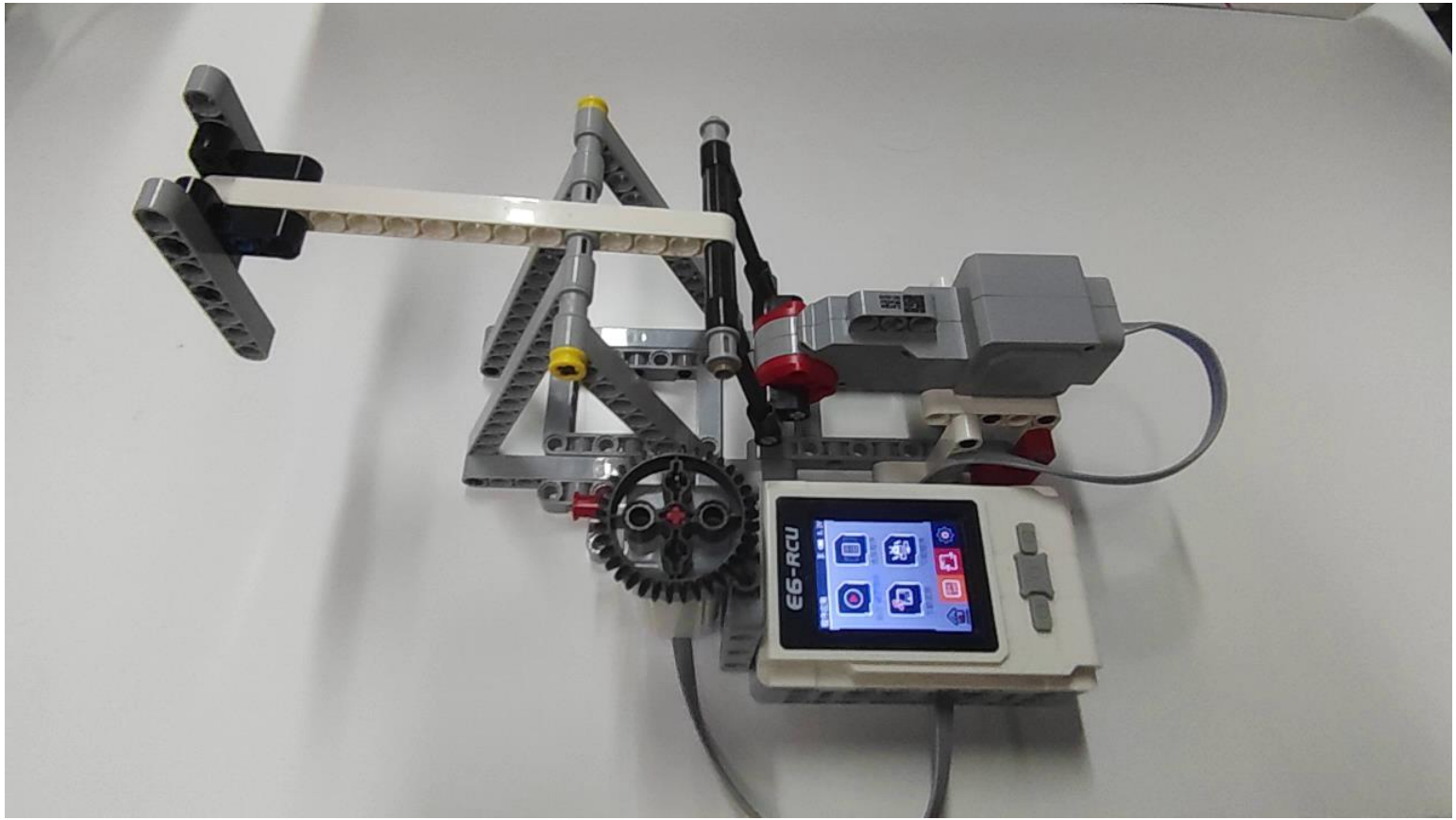
Working principle of oil pumping unit



When the pumping unit is working, the motor underneath will run, driving the walking beam and horse head to reciprocate through the link rod, thereby driving the sucker rod to move up and down to pump up the oil underground.

To optimize the efficiency of oil extraction, the speed of the pumping unit can be regulated according to the actual environment.

Effect Demonstration



Project Tasks

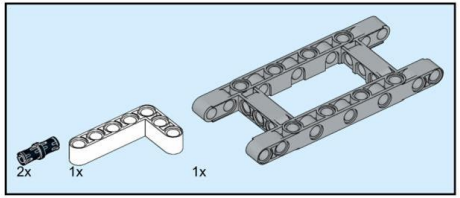
Design an oil pumping unit model that can regulate its speed, and use a motor encoder to control it.

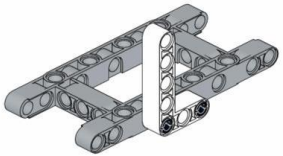
Requirements for robot functions:

1. When the pump is not working, the screen displays "Stop".
2. Turn the knob to the low-speed position, the pump moves at a low speed, and the screen displays "Low Speed".
3. Turn the knob to the high-speed position, the pump moves at a high speed, and the screen displays "High Speed".
4. When the knob is turned beyond the effective angle, the buzzer sounds a prompt.

Build a robot

1





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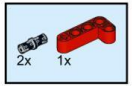

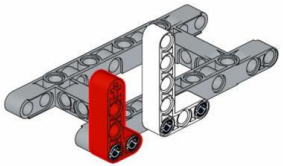

Build a robot

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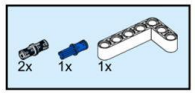

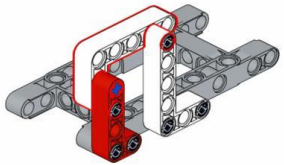

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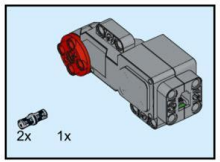
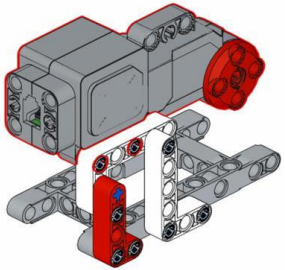
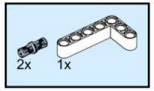
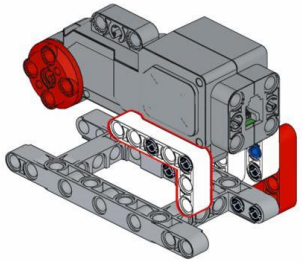




Build A Robot

5





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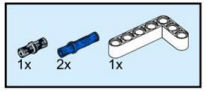
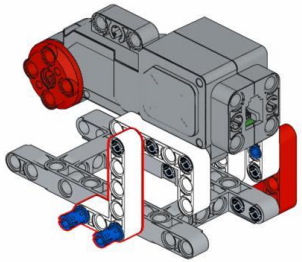
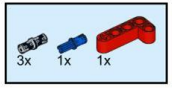
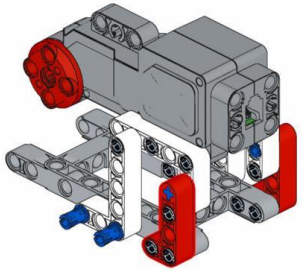




Build a robot

7





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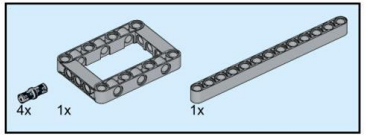
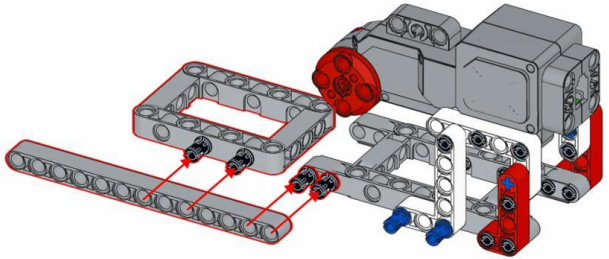
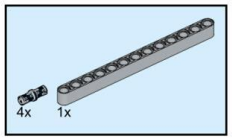
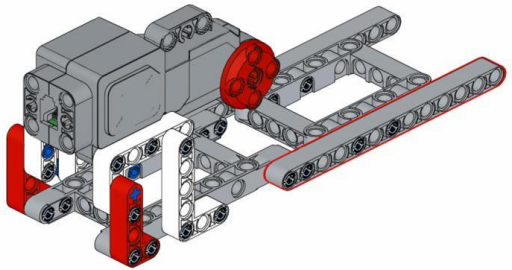




Build a robot

9





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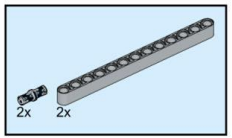
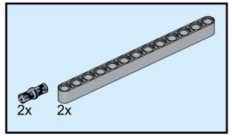
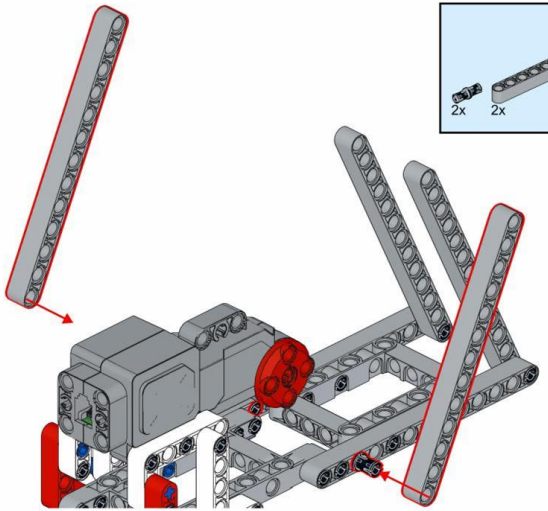


Build a robot

11





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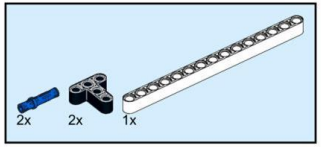

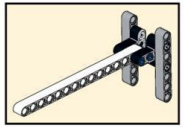

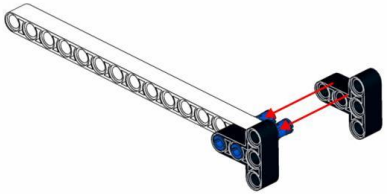

Build a robot

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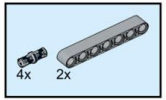

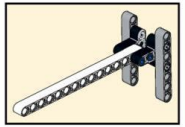

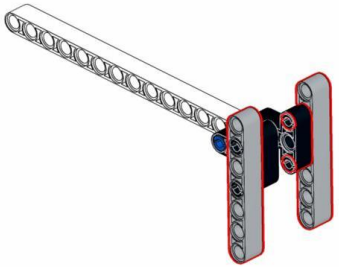

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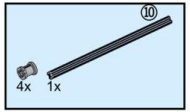
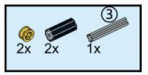


Install the walking beam

Build a robot

15



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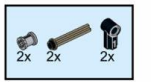
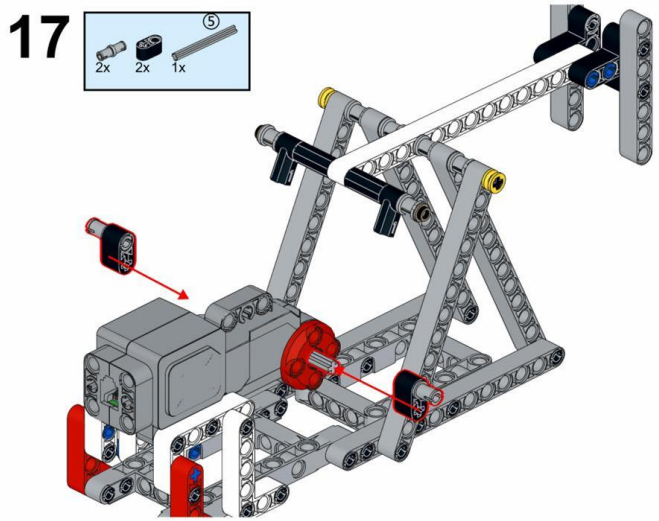
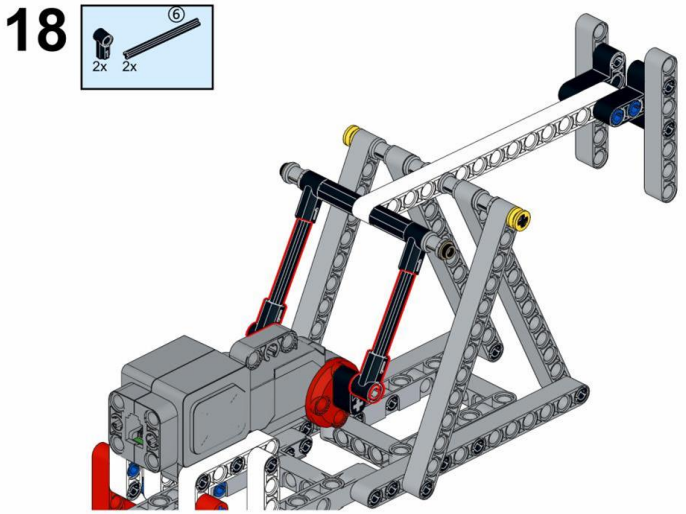


Install the brackets

Build a robot

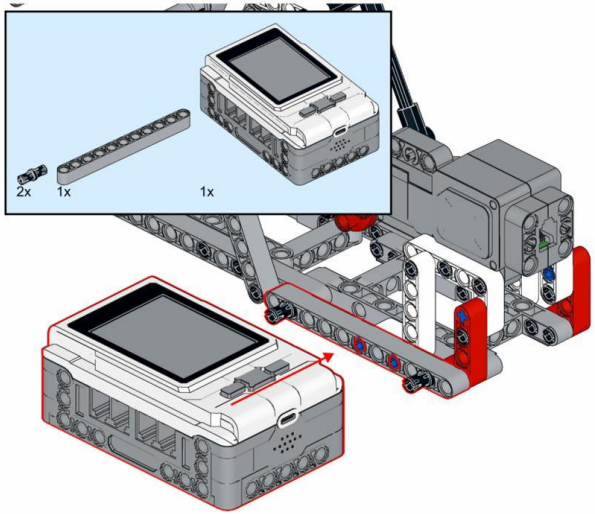




Install the link rod

Build a robot

19



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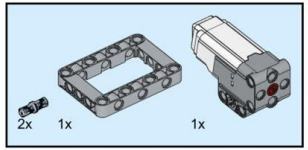
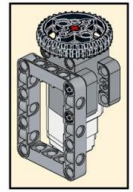
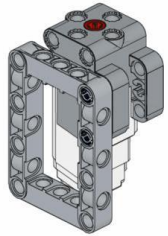


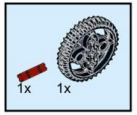


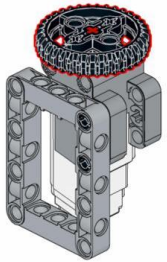


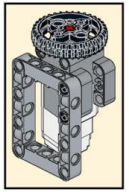
Install the controller

Build a robot

21







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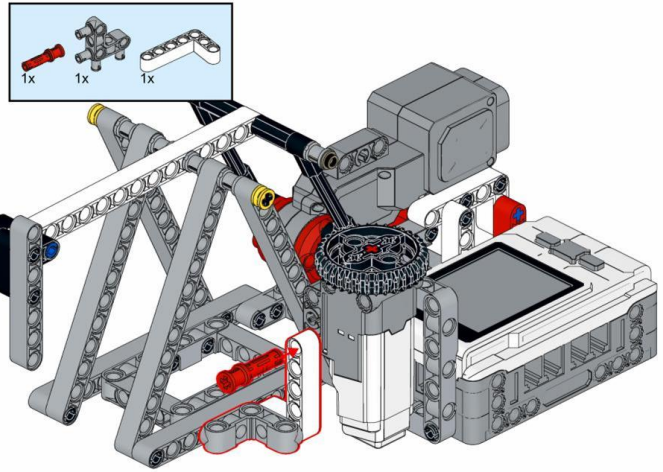
Install the medium motor

Build a robot

23



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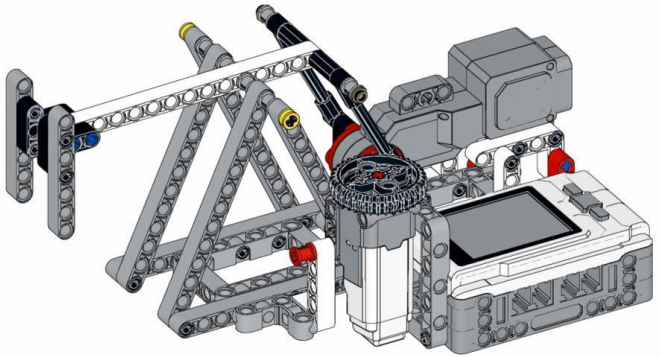
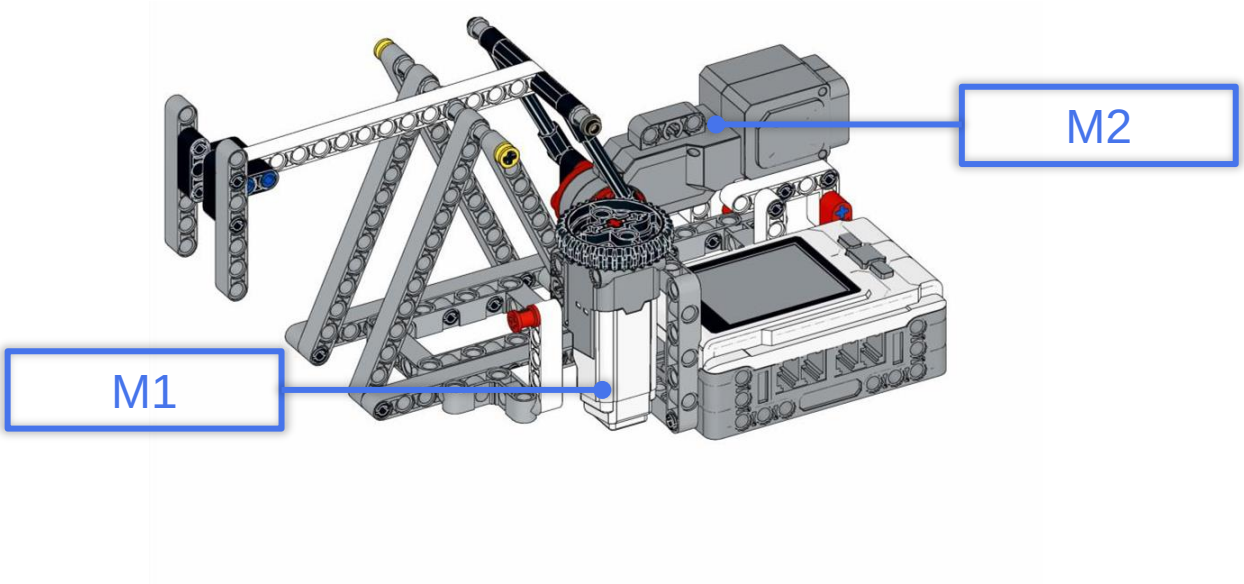


Hardware Connection



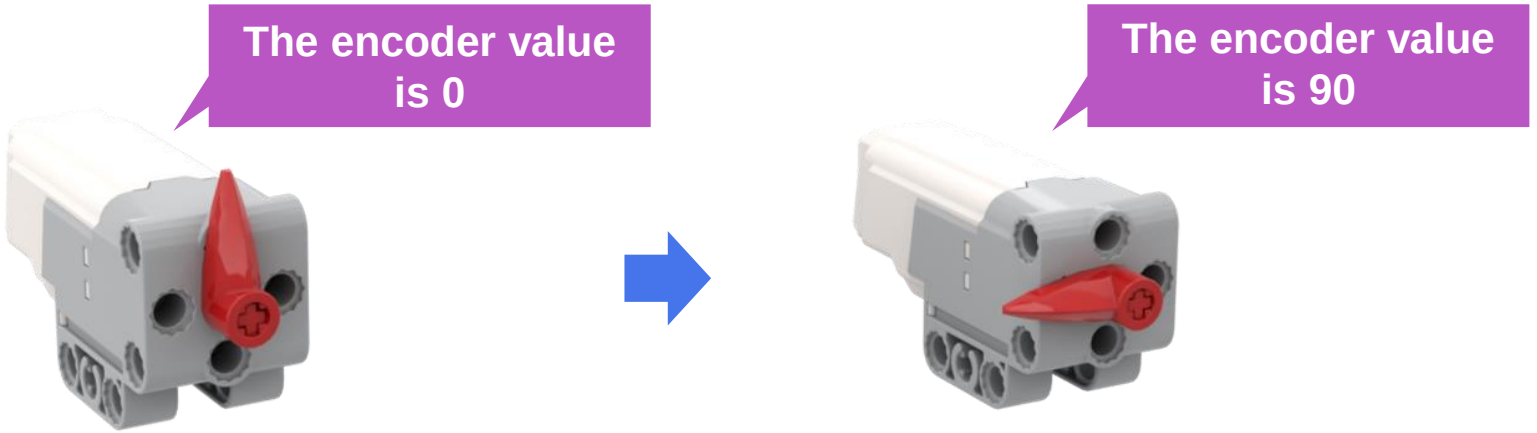
“

How do we achieve the required functions?

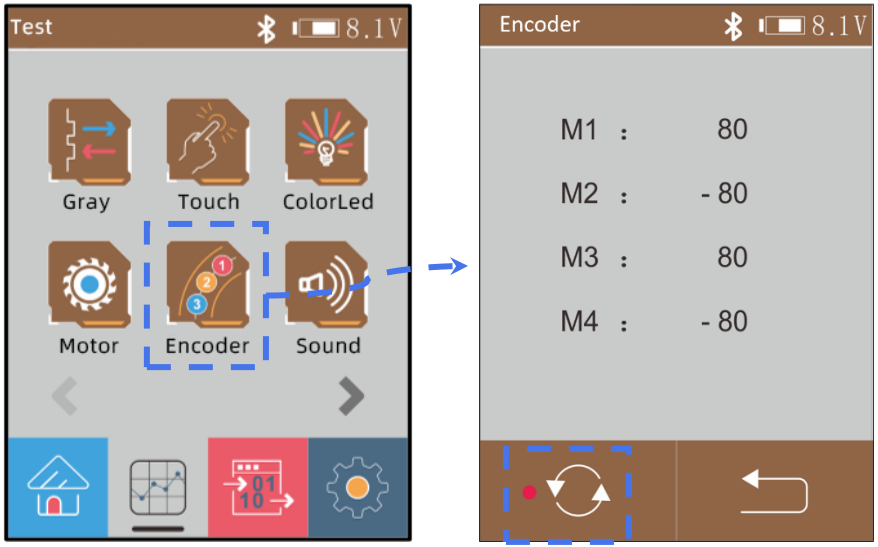
”

Functions of motor encoder

The motor is equipped with an encoder inside, which can read the rotation angle of the motor in real time and return the corresponding value.



Test - Encoder



Reset value to zero

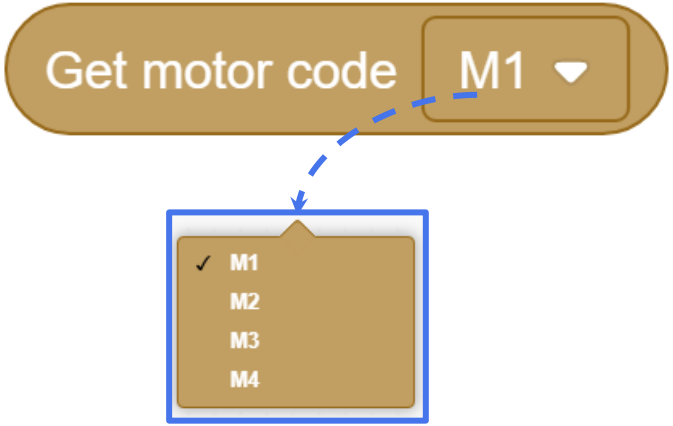
In the built-in test interface, click "Encoder" to enter the encoder test interface.

Turn the knob to observe the change pattern of the encoder value of the test motor.

Change the direction of the test motor to "Reverse" in the “Motor” interface, and then return to the "Encoder" interface to test and observe.

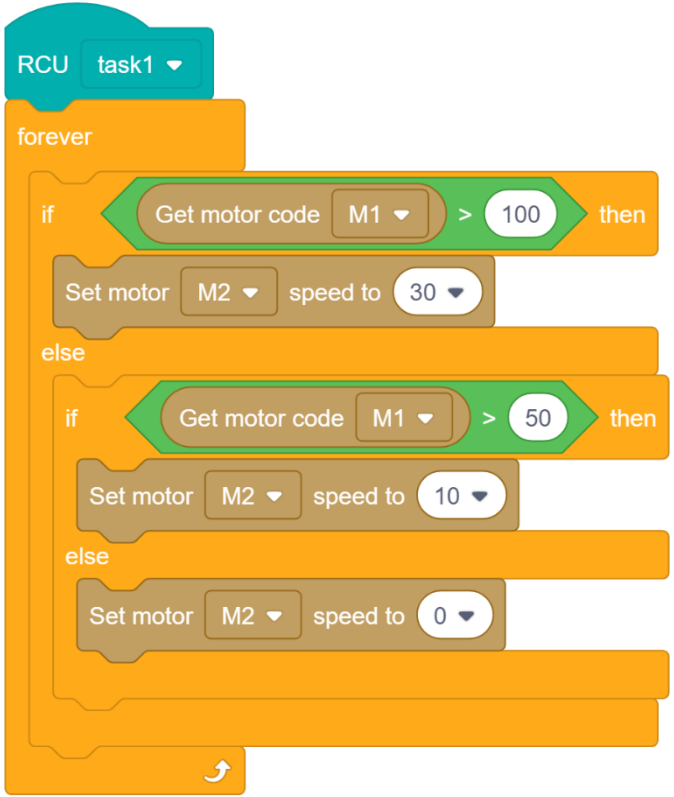
Coding block - get motor code

This module can read the motor encoder value and record the motor rotation angle. The encoder value is the rotation angle, and a negative value indicates a reverse rotation. When the program is initially running, the return value is 0.



Motor port, optional "M1-M4"

1. Turn the knob to control speed

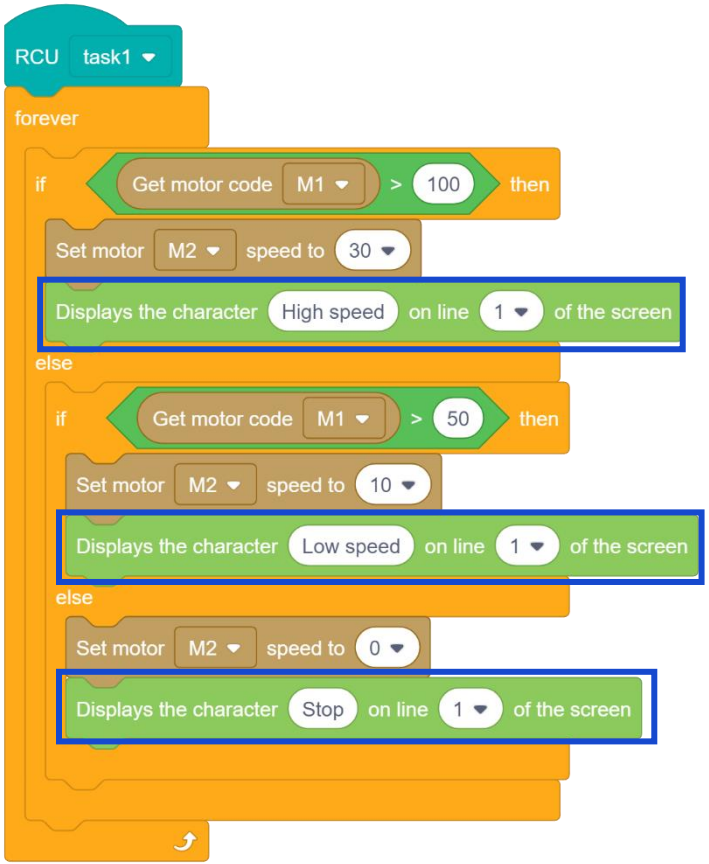


When the knob is not turned, the pumping unit does not move.

When the knob is turned to a small angle (low speed), the oil pumping unit moves at a low speed; when the knob is turned to a large angle (high speed), the oil pumping unit moves at a high speed.

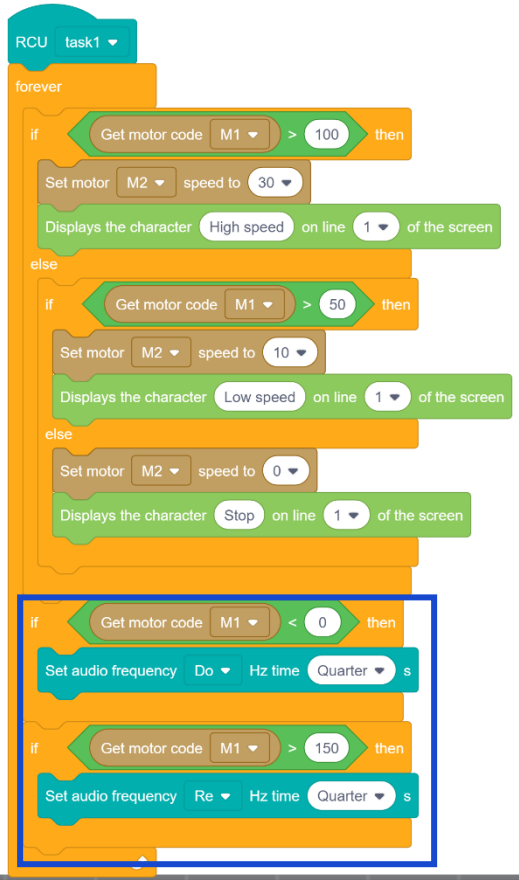
The gear angle can be set independently.

2. Display the speed gear on the screen



Different texts are displayed in different working states.

3. Limit the rotation angle of the knob



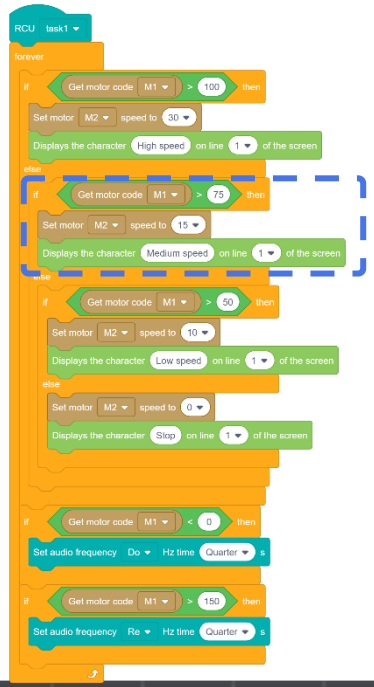
If the knob is turned counterclockwise or clockwise beyond the effective angle range, the buzzer will sound.

Expansion Tasks

Add a medium speed gear



Expansion Program



The angles of high gear and low gear are intermediate, and the movement speed is also intermediate.

Quiz

Single-choice question

Regarding the motor encoder, the following description is correct ( )

A. It can read the speed of the motor

B. Its value range is: 0~360

C. The value can only be positive

D. It can read the angle of the motor rotation in real time

Answer: D

Further Reading



Adjusting the speed of the pump can optimize oil production efficiency, protect the oil layer, adapt to different oil production environments, and ensure safe production.

The speed of the pump directly affects the oil production efficiency. If the speed of the pump is too fast, the oil in the oil layer may not be completely pumped out, thus wasting resources; if the speed of the pump is too slow, the oil production efficiency will be reduced and the oil production cost will be increased.

During the oil production process, if the pump is too fast, it will cause certain damage to the oil layer, thus affecting the quality and quantity of the oil.

Further Reading



Different oil production environments require different pumping speeds. For example, in a heavy oil environment, due to the high viscosity of the oil, the pumping speed needs to be reduced to better extract the oil; in a thin oil environment, due to the low viscosity of the oil, the pumping speed can be appropriately increased to improve oil production efficiency.

During the oil production process, adjusting the pumping speed can ensure the safety of the oil production process and avoid excessive load on the pumping unit, which can cause mechanical failures and safety hazards.

Thanks!