

EXPERIMENT 1

Encoders on robotic arms

Encoders are used in devices that need to operate in high accuracy. They are monitoring the rotation of a motor and send a feedback signal that can be used to determine its position, speed and direction. For example, in an automotive assembly line the robotic welding arms have to assure that they have the correct position to weld in the correct location.

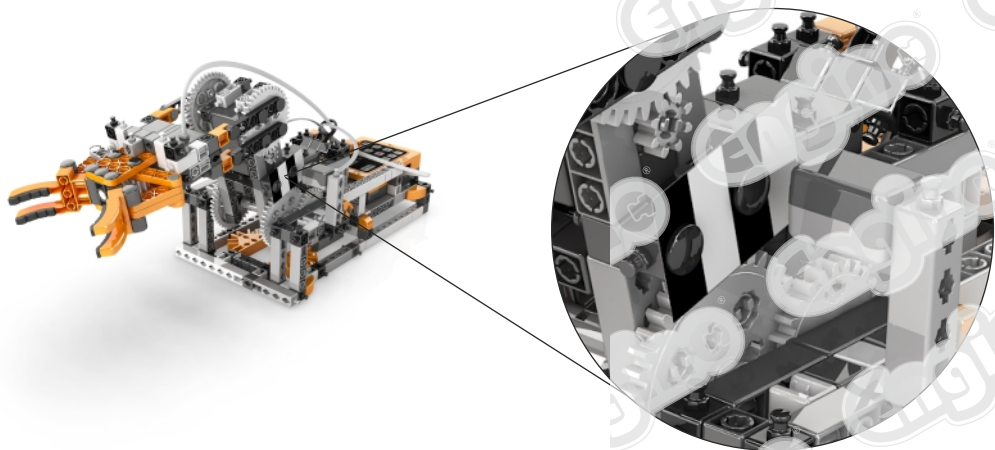


Encoders are used in robotic arms

The most common technology is the “optical sensing” in which the encoder provides feedback based on the interruption of light. That is, a disk with black and white areas is placed on the motor so that it can cause a cycle of sequential change to the reflected light when measured by a sensor. Hence, the exact position of the motor can be extracted by counting this signal alternation.

Step: 01

Follow the instructions of the last pages to modify the Robotic Arm model and add the “encoder disc” to your robot. Make sure that it is attached to the correct position.



Step: 02

Open KEIRO™ software and make sure the PRO controller is selected in the interface. Read the instructions of **Exercise 1** which will help you on creating a basic code that can be used as a counter. Then read **Exercise 2** to further expand your skills on programming the robotic arm and utilize the infrared sensor as an encoder.

Exercise: 01

Download the code that is given and then load it to KEIRO™.

KEIRO™ CODE: [DOWNLOAD](#)

Alternatively you can replicate the code blocks through the image.

This is a code in which it counts the number of times that the Infrared sensor is detecting a white surface.

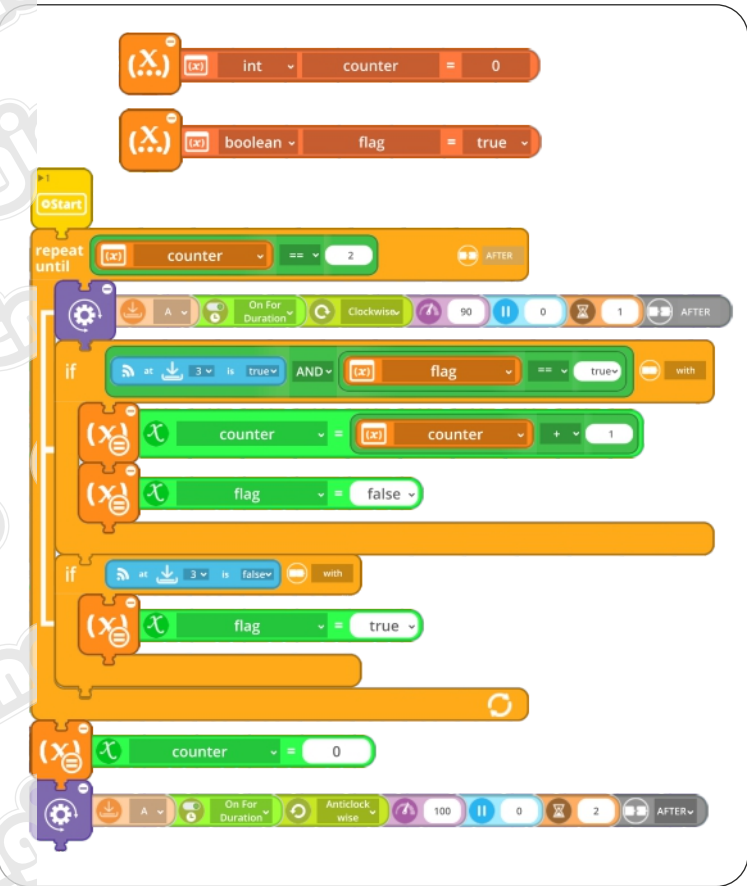
The code does the following.

- **Motor A** is rotating **clockwise**, until the infrared sensors detects a **white area twice**.

Then, **Motor A** rotates anticlockwise for 2 seconds to bring the arm to its starting position.

Send this code to the robot and test how it behaves. It should read the black and white areas, and stop the arm when the sensor reads the second white area.

Can you modify the code and make the arm stop at the first white area instead? Is just one parameter that you shall change to achieve this!



Exercise: 02

Now is time to make the robotic arm move like an industrial robot that continually moves back and forth, while the infrared sensor is assuring that it will automatically stop on the exact same position.

Make the necessary adjustments to this code so that the robot does the following actions.

- **Motor A** is rotating **clockwise**, until the infrared sensors detects a **white area twice**.
- Then the buzzer emits a tone for 1 second to signify that the arm has reached it correct position.
- Once the buzzer stops, the **hand of the arm closes** to catch something (i.e a pen)
- Then, **Motor A** rotates **anticlockwise** for **2 seconds** to bring the arm to its starting position.
- Once the motor A stops, the **hand of the arm opens to release the object**.
- All of the above actions shall be **repeated forever** in a loop.



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