

Fan solutions

For the manual solutions, push the buttons on the controller in the specified order depicted by the arrows. When two buttons have the same number, you should push these buttons simultaneously.



Exercise 1. Push the buttons on the ERP device (input) and write briefly the outcome you observe on the model (output).

Input	Output
Motor A switch in position I	fan rotates clockwise
Motor A switch in position II	fan rotates anticlockwise

Exercise 2. Create a second fan for your model at the opposite side of the first fan and connect the second motor in port B. You can see a building example on the right.



Exercise 3. Press "Program" (red flashing light indicates that the program is being recorded) and then the necessary buttons to create the following sequence:

- fan A rotates clockwise;
- fan B rotates clockwise;
- both fans rotate at the same time in opposite directions;

Press the "Program" button again to save the program and then press the "Play" button to check if the command sequence is correct. If you press and hold the play button for longer time the program will go into loop.

Exercise 4. On the flow diagram, right-click on each block in order to make the appropriate changes described below. You can add more actions (motors, idle time) from the left menu:

- fan A rotates clockwise for 2 seconds with 100 speed;
- fan B rotates clockwise for 2 seconds with 100 speed;
- robot does nothing for 1 second (use idle time block);
- both fans rotate at the same time in same directions for 3 seconds, A with 100 speed and B with 40 speed.
- the program should activate 1 time only. Right-click on the start block and change number of repeats.



Exercise 3 solution program

For the solution of exercise 4, click on the link below. This will open the solution program in the ERP MINI software. Connect the fan model with the PC through USB, click on the USB button and send the program to the controller. Push play to test it.

[Fan - ex. 4 solution program](#)

Hexapod solutions



Exercise 1. Drag and drop the peripherals (motors and sensors) into the ports of the ERP simulator, according to the hexapod model. Choose IR OBJECT for the two sensors, as you will need them for later activities. Design the blocks in the picture here as well.



Exercise 2. Control hexapod using the ERP MINI Simulator according to the following sequence:

- the hexapod turns right using one leg;
- the hexapod turns left using one leg;
- the hexapod moves forward with both legs;
- the hexapod moves backwards with both legs.

Tip: to move forward and backward you should click on two motor buttons at the same time. For this, click on "multiple select" button, choose the appropriate motor buttons and then click on "multiple record".

Exercise 3. What problems might arise when legs are used for robotic movement instead of wheels?

Legs are less stable and move slower than wheels because they lose

contact with the ground when the robot is moving. Legs are usually

more difficult to construct as they require a complex design of

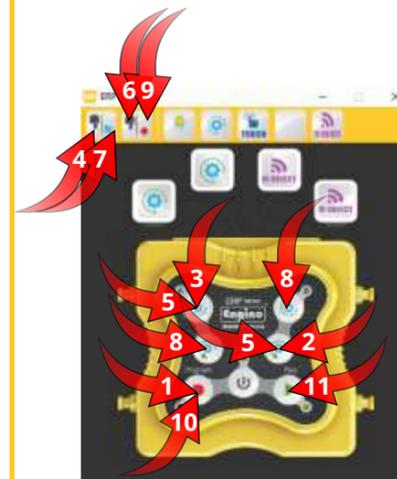
linkages that will work as joints, similar to the joints of the knees.

Exercise 4. Create the following program so that the hexapod avoids obstacles at either side:

- hexapod moves forward continuously;
- if the left IR sensor detects an obstacle, the right leg should move backwards and the left leg should move forward;
- if the right IR sensor detects an obstacle, the left leg should move backwards and the right leg should move forward.

Place the appropriate blocks inside the IF block. Consult **page 16** on how to configure the IR sensors for **object detection**.

For the exercise 2 solution, push the buttons on the simulator in the specified order depicted by the arrows. When two buttons have the same number, you should push these buttons simultaneously.



Exercise 2 solution program

For the solution of exercise 4, click on the link below. This will open the solution program in the ERP MINI software. Connect the hexapod model with the PC through USB, click on the USB button and send the program to the controller. Push play to test it.

[Hexapod - ex. 4 solution program](#)

Robo solutions

For the solutions of the exercises, click on the links below. This will open the solution program in the ERP PRO software. Connect the robo model with the PC through USB, click on the USB button and send the program to the controller. Push play to test it.



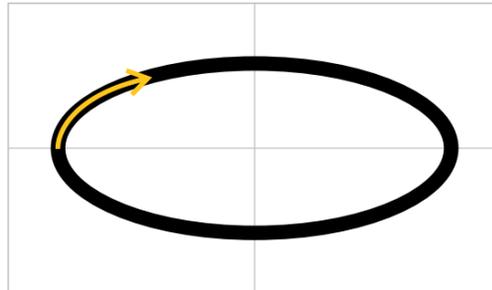
Robo - ex. 1 solution program

Exercise 1. On the computer, place the correct icons on the ERP simulator according to the Robo model. Drag and drop the necessary blocks inside the flow diagram in order to create the following program to move on white and fix its path on black:

- **while** the IR sensor in port 1 detects white colour, the motor in port A should rotate forward;
- **while** the IR sensor in port 2 detects white colour, the motor in port B should rotate forward.

Once you place the appropriate blocks, you will need to **configure the infrared sensors**, so that they **detect white colour**. For this, consult the user manual under the section "Infrared sensor configuration" in **page 16**.

With this program Robo will follow a black line. In order to test your program, place your robot on the black ellipse you created and see if it goes around with its lights on.

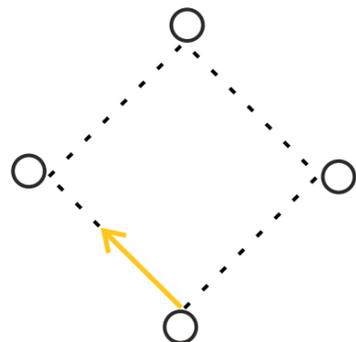


Robo - ex. 2 solution program

Exercise 2. Drag and drop the necessary blocks inside the flow diagram in order to create the following program:

- Robo moves forward;
- **if** it detects a white object with **either sensor or both**, the robot should stop;
- after 5 seconds the humanoid should turn 90 degrees to the right in order to detect the next object.

Tips: the angle is always the same, so only one program is needed for turning. To set both or either sensor to detect objects you must choose the appropriate logic gate (AND or OR). You should also **configure the sensors** again so they will activate on **object detection** this time.



Twister robot solutions

For the solutions of the exercises, click on the links below. This will open the solution program in the ERP PRO software. Connect the twister robot model with the PC through USB, click on the USB button and send the program to the controller. Push play to test it.



Twister - ex. 2 solution program

Exercise 1. Create a simple program manually to rotate the arm. Place the robot on the floor and see what happens when you play the program. You will observe that the base is rotating as well. To fix this problem, connect a yellow pulley under each of the 4 corners of the base. For more stability, you can place the pulleys on sticky tape. Try the program again.



Exercise 2. On the computer, place the correct icons on the ERP simulator according to the twister model. Drag and drop the necessary blocks inside the flow diagram in order to create the following program:

- the twister should rotate for 1 second and then close and open its arm.
- this routine should be repeated 5 times.

Tip: change the variable of the "start" block from "forever" to "1" and use the "repeat" block to create the program. Remember to remove the USB cable from the model before you play the program.

Twister - ex. 3 solution program

Exercise 3. Create the following program (the grip of the arm should be open at the beginning):

- the twister should rotate continuously **until** the side IR sensor is triggered by an object or a hand.
- when the model is stopped, if a can is placed in front of the arm's IR sensor, the grip should close to hold it.

Tip: use the "repeat until" block for the first part of the program and modify the arm for better grip if it's needed.

Twister - ex. 4 solution program

Exercise 4. Place a can inside the arm of the model and create the following program:

- the twister should rotate 180 degrees to the left holding the can.
- when the model is stopped, the arm should open and release the can.
- then the twister should rotate 180 degrees to the right (that is back to its initial position).
- when a can is placed in front of the arm's sensor, the grip should close to hold it and then repeat the procedure (turn 180 degrees, release the can and rotate back).

Tip: place two objects (or use your hand) on either side of the middle sensor to trigger it.