# TUTORIAL 3: 2, 1 AND… RUN!

Description: Robots have different parts and a very important one is the motors. Without motors, robots would not be able to move. The brain of our robot can give the instructions to different kinds of motors. The motors are connected externally. In this tutorial you can follow all the steps involved in connecting and programming orders for DC motors.

Materials needed:
- USB Cable
- Duinobot v1.1 or higher (or any board, just check what kind of batteries and motor it needs)
- Computer with miniBloq (v0.81 or higher)
- 3 x AA batteries (rechargeable recommended, protect the environment!)
- 1 x Motor 12VDC Multiplo compatible
- 2 x Cable (red) Multiplo compatible

STEP 1: Connect the batteries as the motor needs more power than the provided by your USB. Remember to use 3xAA alkaline or rechargeable Ni-MH batteries. Switch it ON after connecting the batteries.

For those ready to swim into deep waters, the voltage used by motors is 12VDC but the voltage provided by the USB is only 5VDC. The board "powers up" from the AA batteries. It then pumps it up to the 12VDC so it is easy to use. You can see this because it switches a blue light on the board when it is ON.
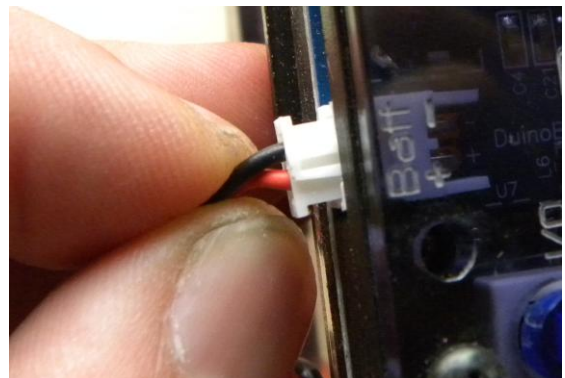
STEP 2: Connect the red cable into the motor output. You can use the M0 signal as in this example. Connect the other side of the cable to the motor.
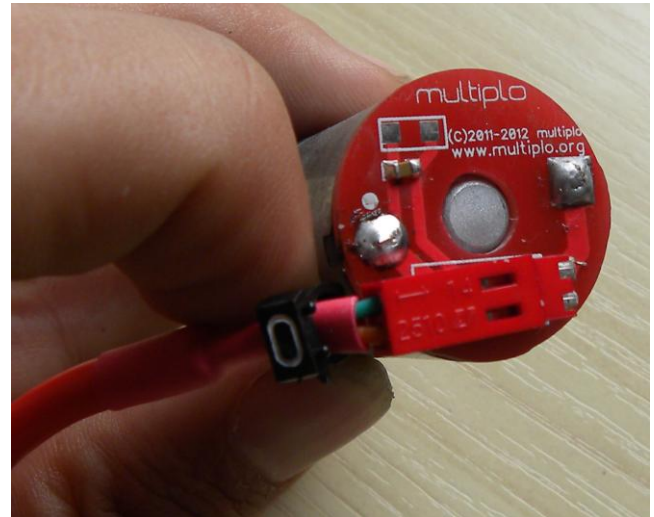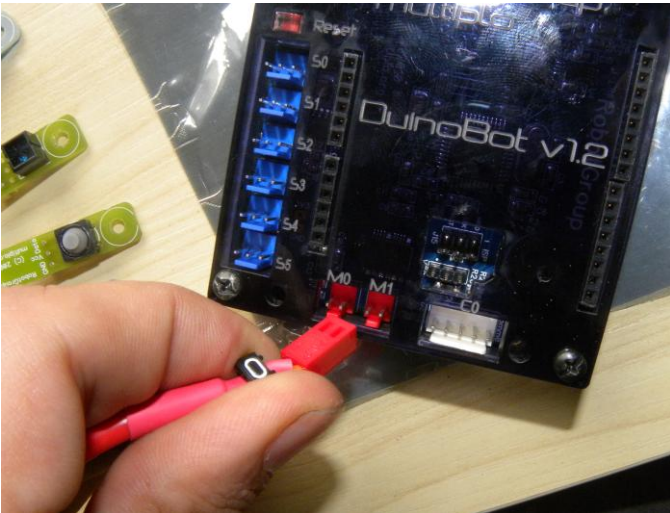

STEP 3: After connecting the board with the mini-USB cable, switch it ON. Make sure that the Hardware has your correct model of board. You should select the port with which it communicates and the type of board in the "hardware" miniBloq section (top left side of the screen).
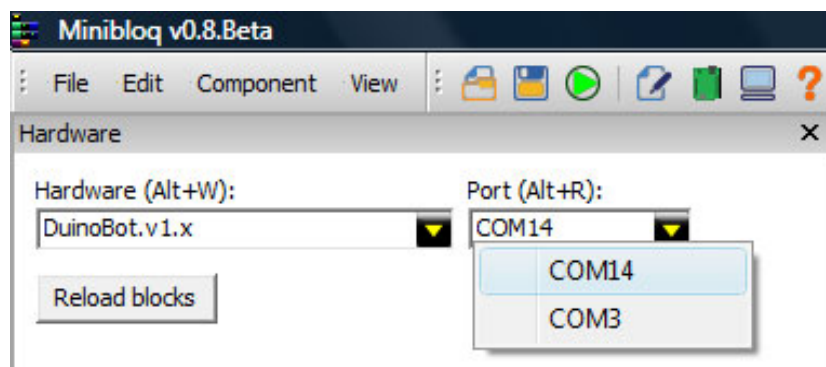
STEP 4: Once the board is connected and miniBloq is properly configured, create a new project, selecting from the "File" menu, the option "Create".
On your empty and new sketch, select the gears icon, which symbolizes setting the motor state.

Select this icon
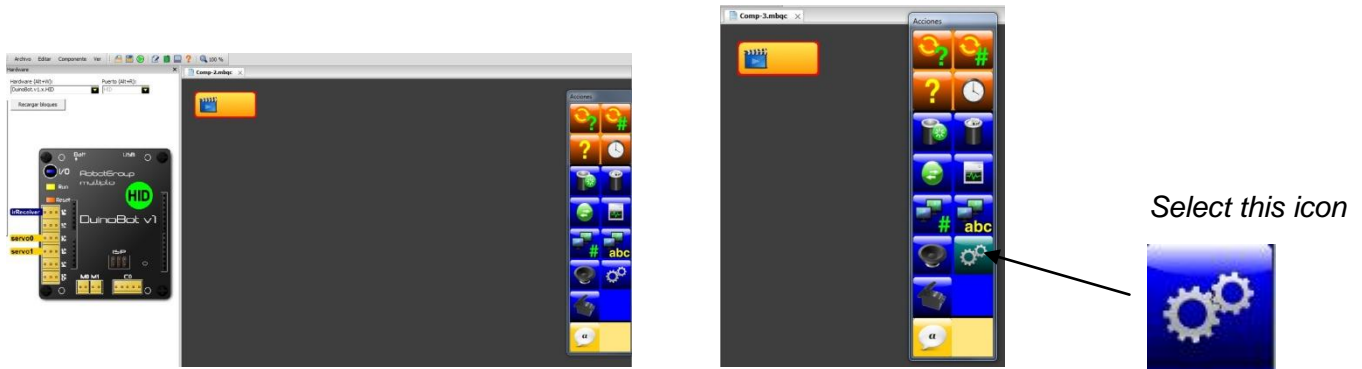
STEP 5: Note that there are two options in RED, showing that should be completed. Click on the bottom menu to display the motor menu and select the motor (0 or 1) to which you want to give orders, the one that is connected to your board.

Click to display the menu
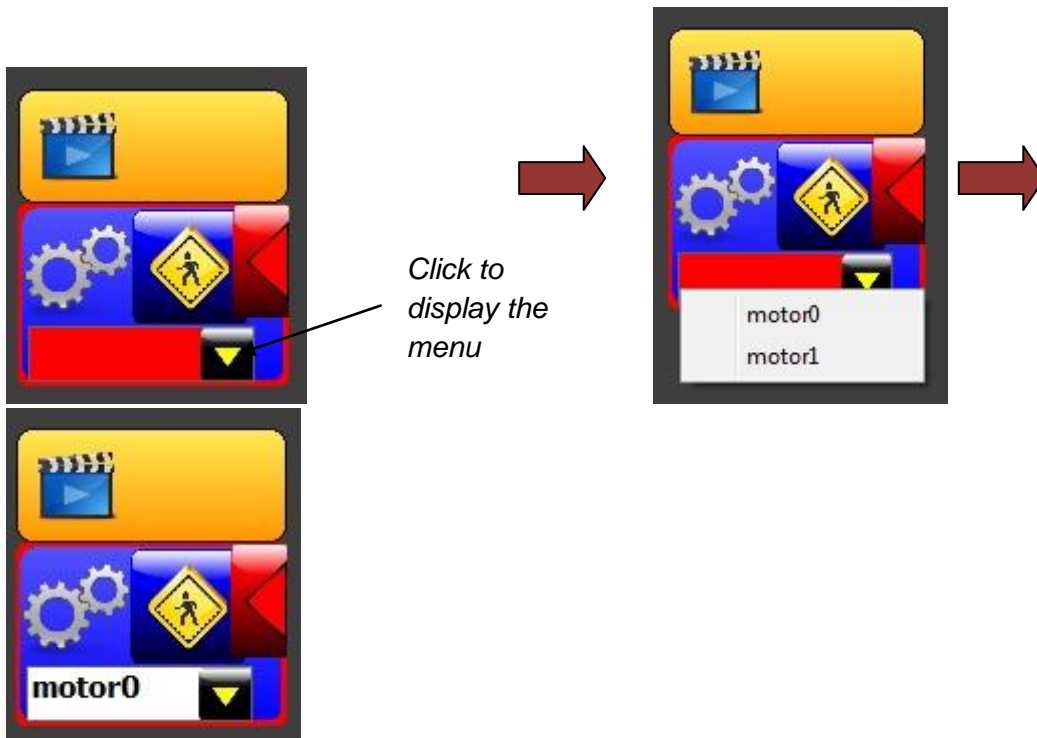
STEP 6: Click on the right label and then select the icon of number (#) to set the speed to a constant number (just to say how fast it will go). Select the speed from 0 to 100. (It is a percentage but there is no need to add the symbol).
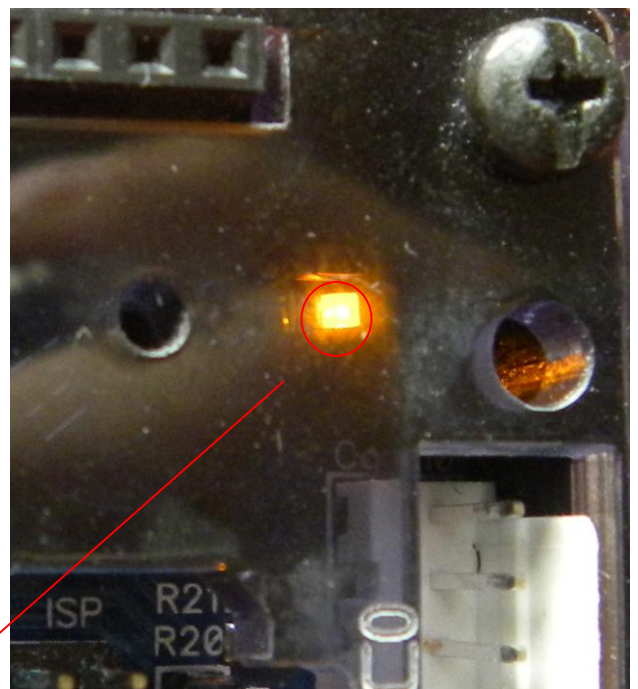
Select this icon
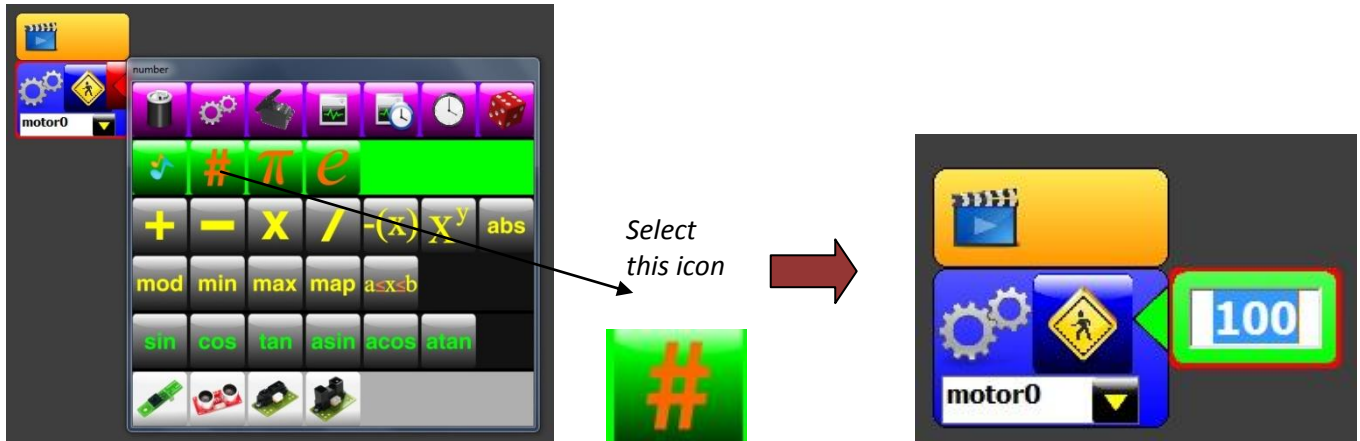
STEP 7: Press the "Run" icon, so that the orders can be downloaded from the computer to the board.

Select this icon

The program will be downloaded to your board. The yellow LED should be blinking for some seconds, showing that it is programming the board and then… your program will be executed. 3! 2! 1! RUN!!

If the motor is running, you did everything correctly. Now you can try to repeat all the previous steps with different speeds to see the results.

> *If the motor is not running at this step, do not panic. Check again cables, switch and batteries. Reset it with the button on the board and program it again. No scientist got things working at the first try.*

Yellow LED blinking

STEP 8: The output of the motors are the kind of "STATE". So your motor will be running endlessly. Pretty dumb, isn't it? In order to set the time you want the motor to run at that speed, select the clock icon in the right hand menu. This will add an instruction below. Then click to input the time like you did with the speed, selecting the red arrow that appears and then, from the menu, the number icon (#).

The bigger the number, the longer it will take to execute the next instruction. Try with 5000 to start with. That will make the CPU wait for 5 seconds

Pssst! .. a secret: the number you are entering for the clock icon is in milliseconds. The measure millisecond is so tiny that we cannot see it with our eyes. Movies, for instance, run each frame around 60 milliseconds. The input will be in a very tiny number because the CPU of our robot goes fast. It will count till 1000 when you only count 1 second.

*Select this icon*

Select this icon
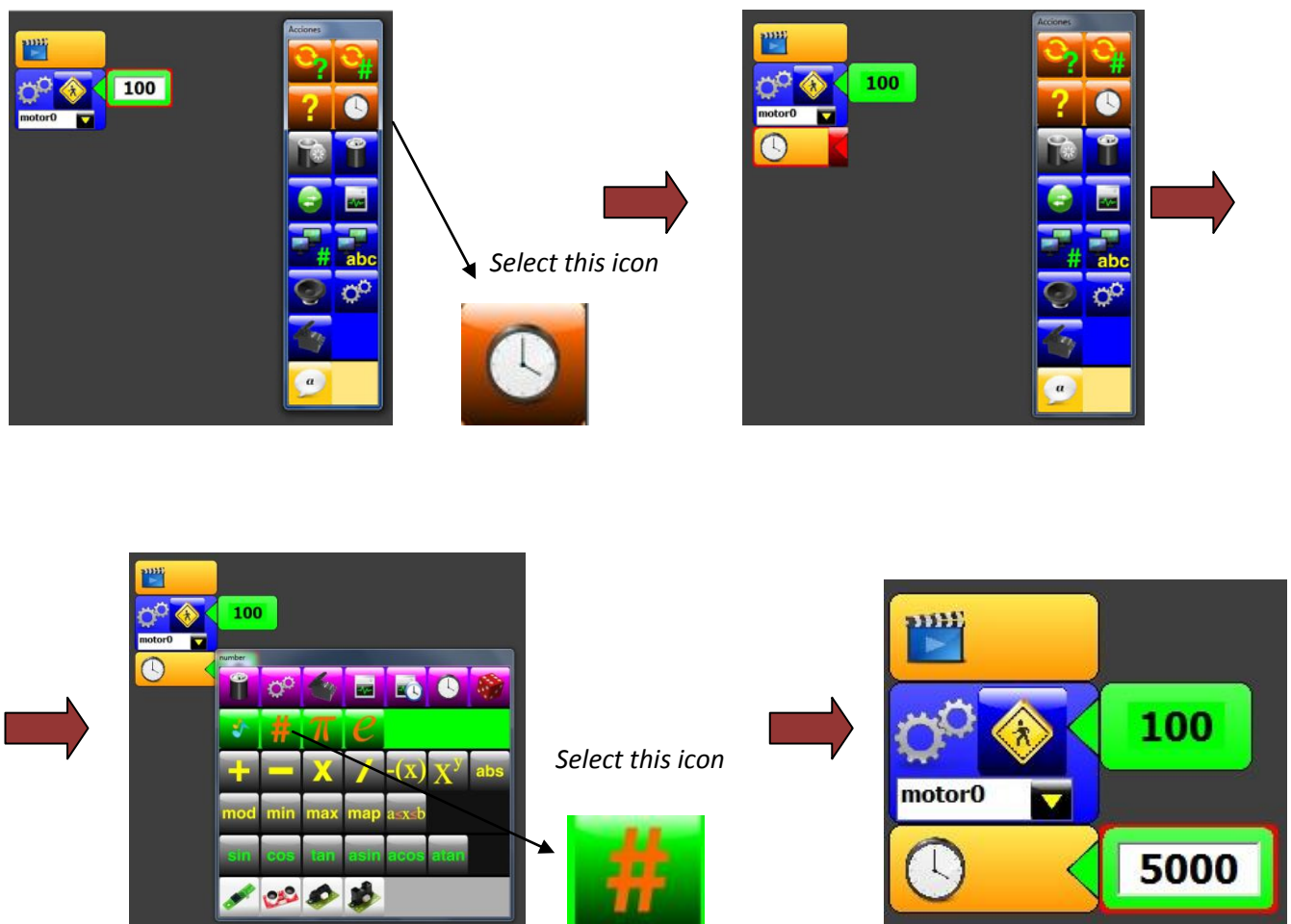
STEP 9: In order to make the motor STOP after it has been running, you need to give a new order to it. The order will be to set a new state of the motor, but with speed 0. To do so, go to the last block and press again the "gears" icon used at step 3.
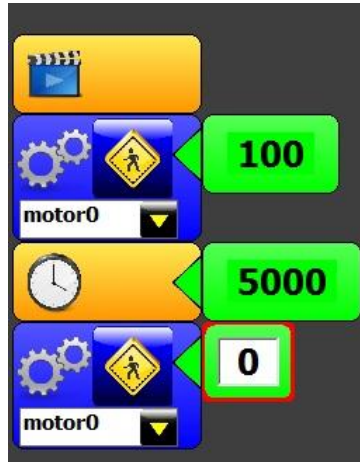
STEP 10: Until now you have only set up a number to the speed. But if you want to go in the opposite direction, you need to tell the program that the number is not positive.

> *When you unfold the menu, notice that icons have different colors. All the grey ones are "operators". You can do any mathematical operation between numbers and inputs, the result will be what you set to that block. In this example, the speed of the motor.*

To make it move backwards, you need to set a negative speed (using the icon minus).

Select this icon
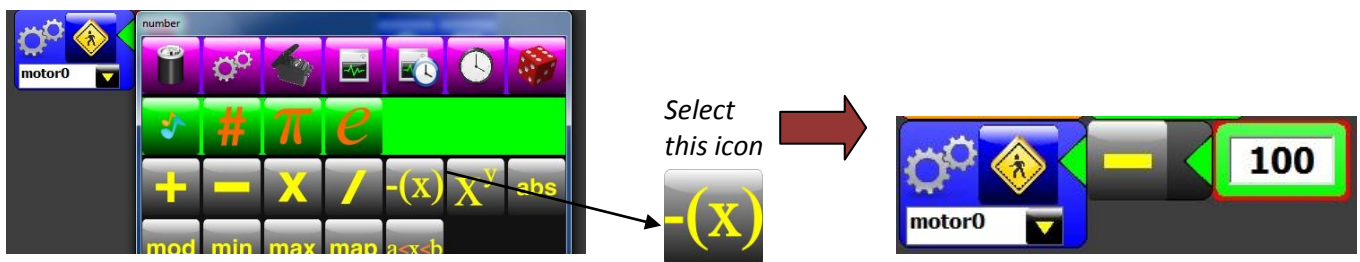
If you want to give news orders, to change the speed or to make it stop, you have to proceed the same way again. You can program your sequence of motor movements in any way you want.