

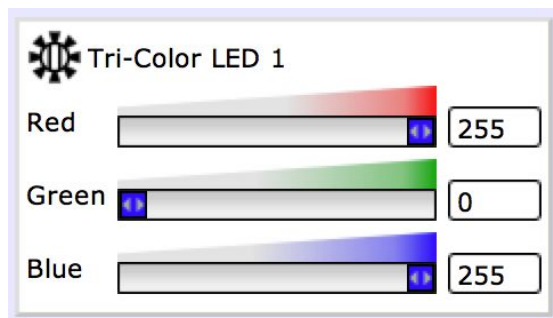
Key for Introduction to Hummingbird with CREATE Lab Visual Programmer

Important Note: For more exercises, many solutions are possible; these solutions are just given as examples.

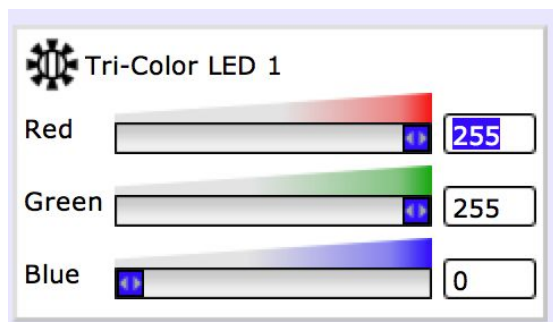
Exercise 1.1. Exploration.

Exercise 1.2.

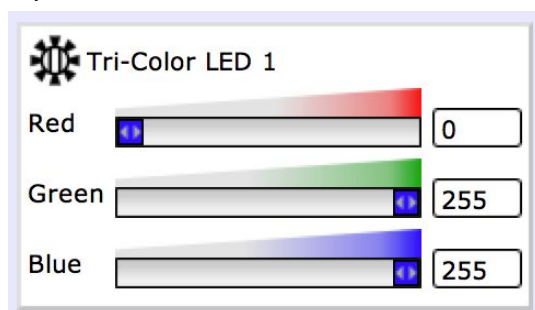
Purple:



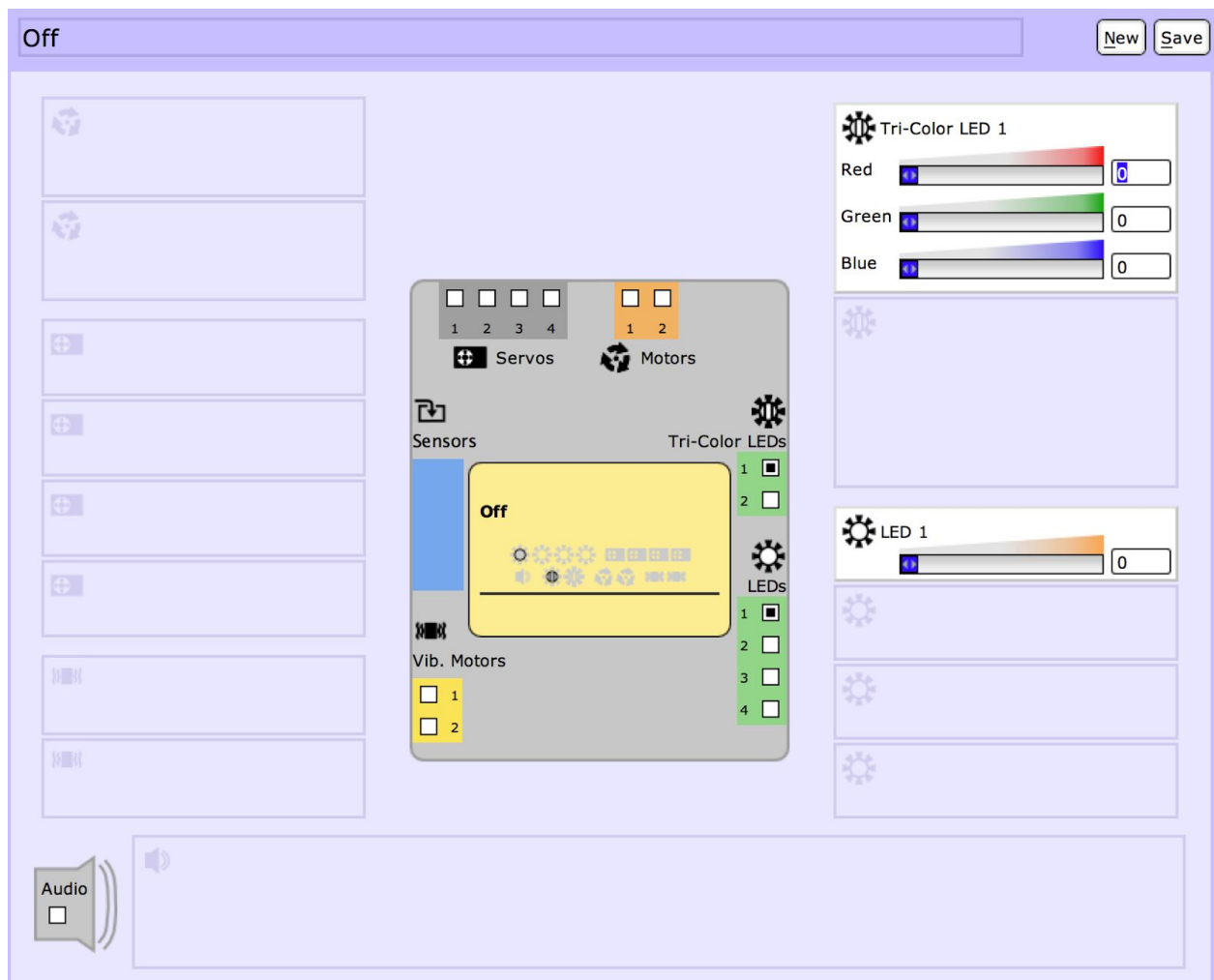
Yellow:



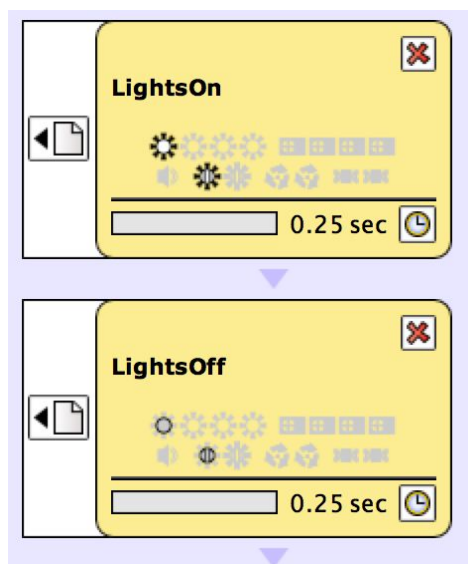
Aqua:



Exercise 1.3:



Exercise 2.1:



Exercise 2.2: Students will need to modify their “off” expression so that the single color LED is off and the tri-color LED is on but in a different color (green in the expression below).

The image shows a block editor interface with a central workspace and two configuration panels on the right.

Central Workspace:

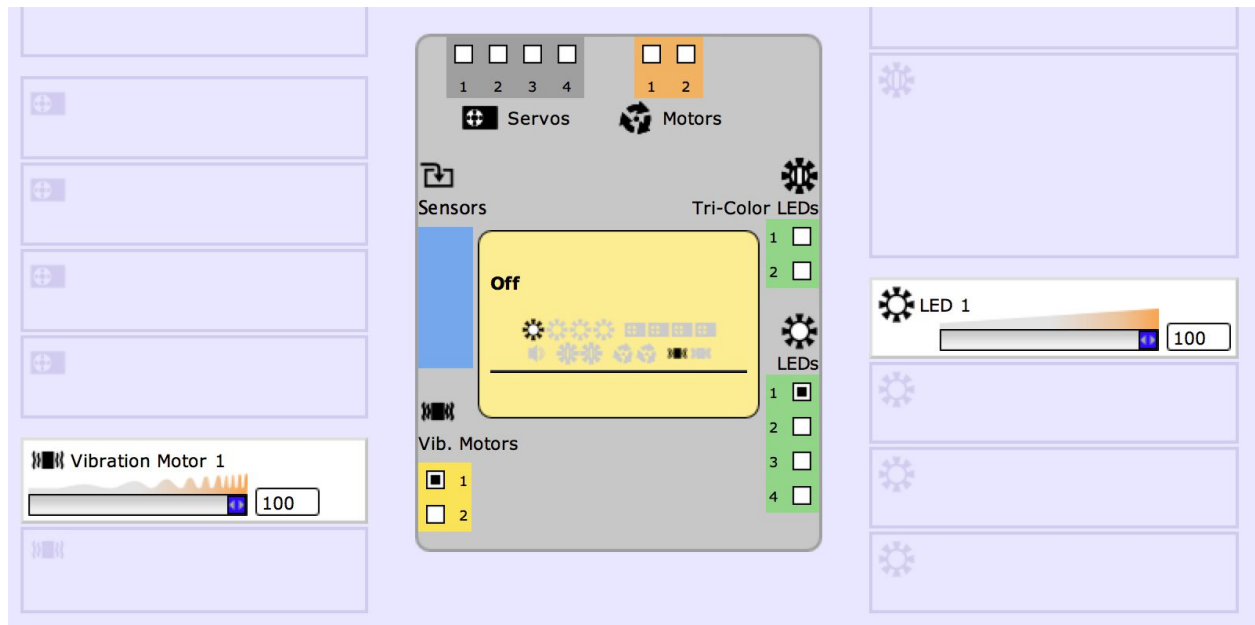
- Sensors:** A blue block labeled "off" is highlighted in yellow.
- Servos:** Four checkboxes labeled 1, 2, 3, and 4.
- Motors:** Two checkboxes labeled 1 and 2.
- Tri-Color LEDs:** A vertical list of checkboxes labeled 1 and 2.
- LEDs:** A vertical list of checkboxes labeled 1, 2, 3, and 4.
- Vib. Motors:** Two checkboxes labeled 1 and 2.

Configuration Panels:

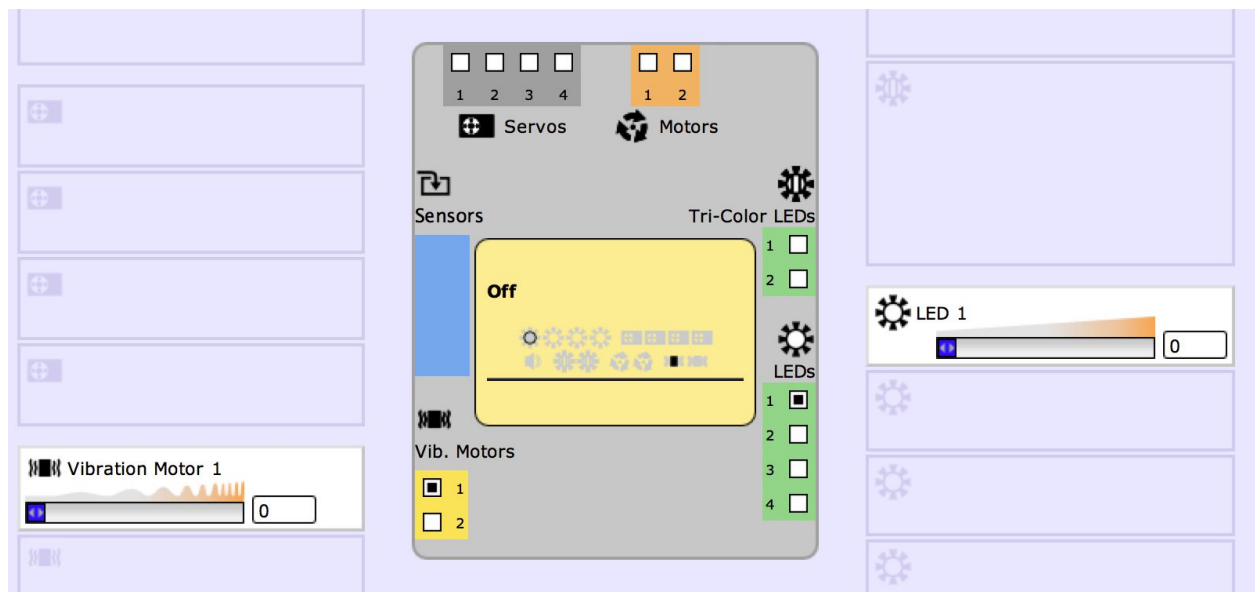
- Tri-Color LED 1:** A panel with three sliders: Red (0), Green (255), and Blue (0).
- LED 1:** A panel with a single slider set to 0.

Exercise 2.3: The sequence should contain four different expressions, and each expression should have a different color for the tri-color LED and a different setting for the single color LED.

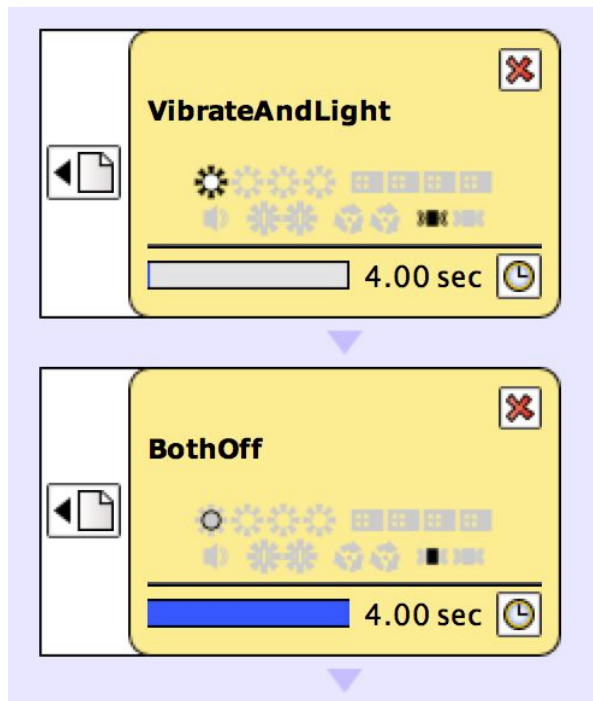
Exercise 3.1:
Expression “VibrateAndLight”



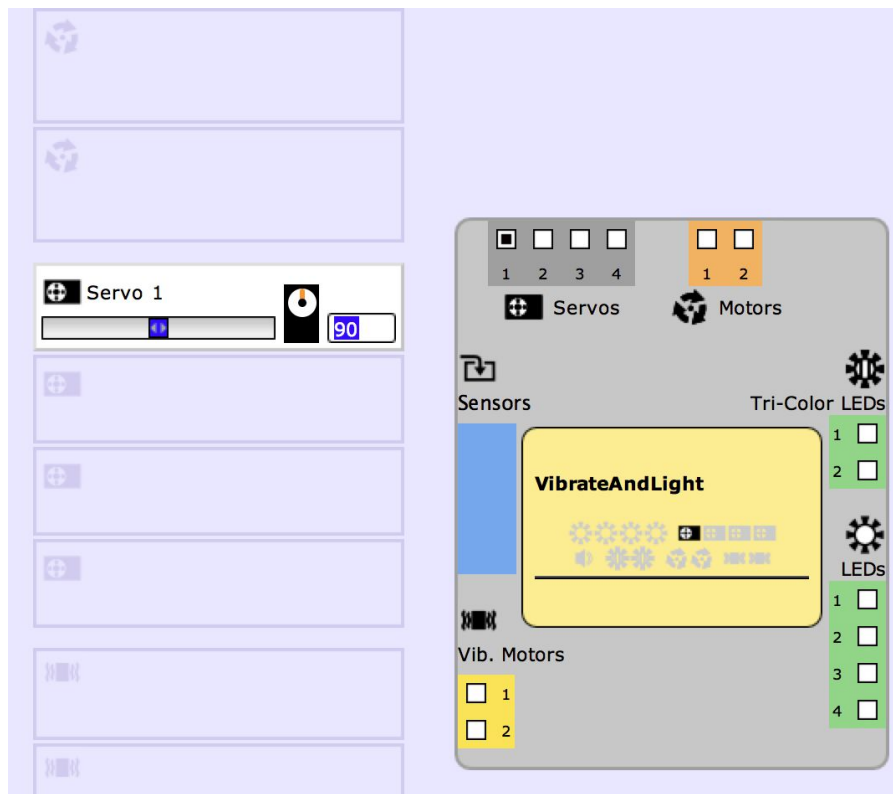
Expression “BothOff”



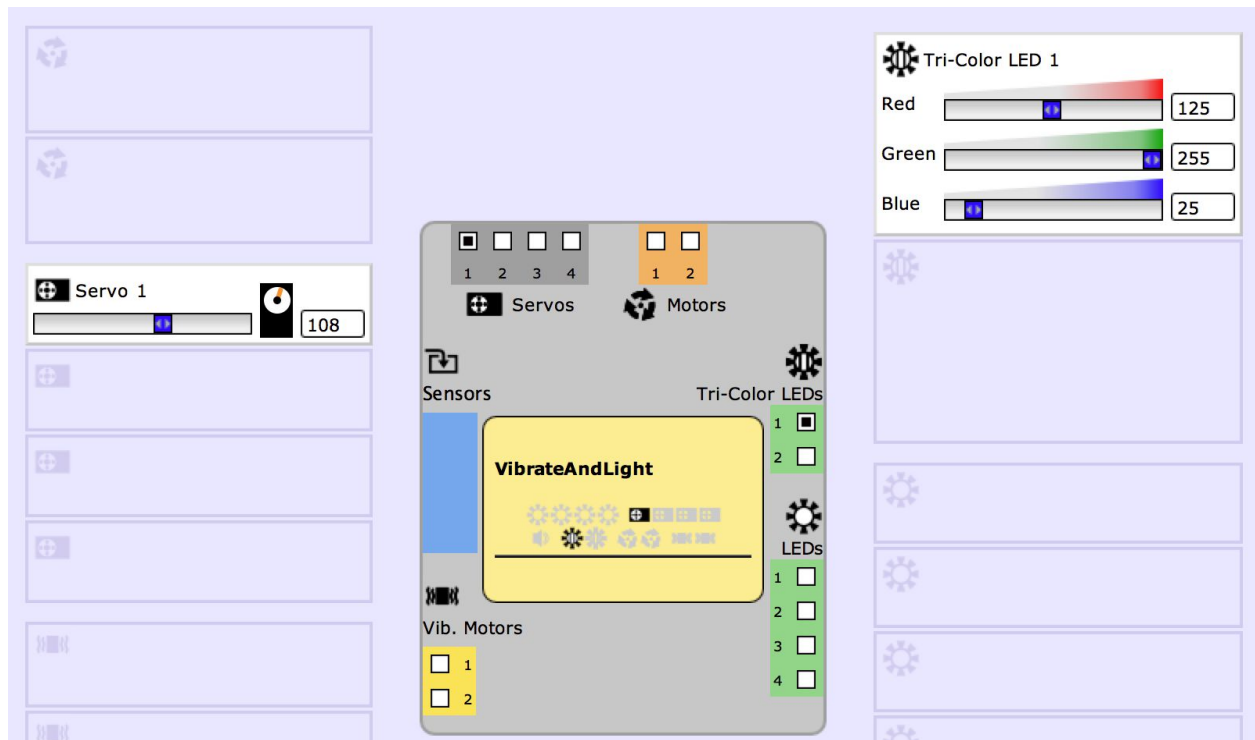
Sequence



Exercise 3.2: The servo expression for 90° is shown below. The expressions for 0° and 180° are similar. The sequence should contain all three expressions.



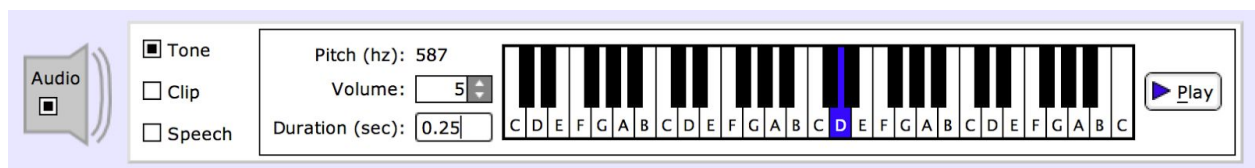
Exercise 3.3. Many different solutions are possible, but the sequence should contain five expressions. Each expression should look something like this one:



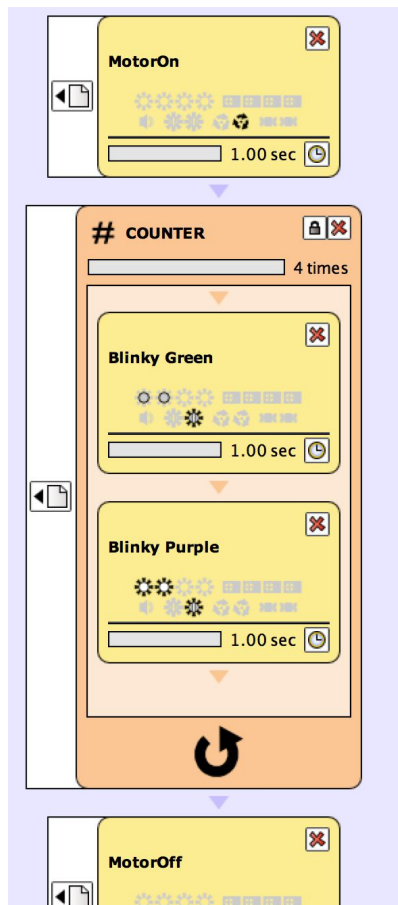
Exercise 3.4: The farther the speed is from 0, the faster the motor rotates. The sign of the speed (positive or negative) changes the direction that the motor rotates.

Exercise 3.5: The sequence should contain two expressions. One expression should include the motor with a positive speed, and the other should include the motor with a negative speed.

Exercise 4.1: A portion of an expression with a sample tone with a duration of 0.25 s is shown below. The sequence will consist of a list of expressions with different tones.

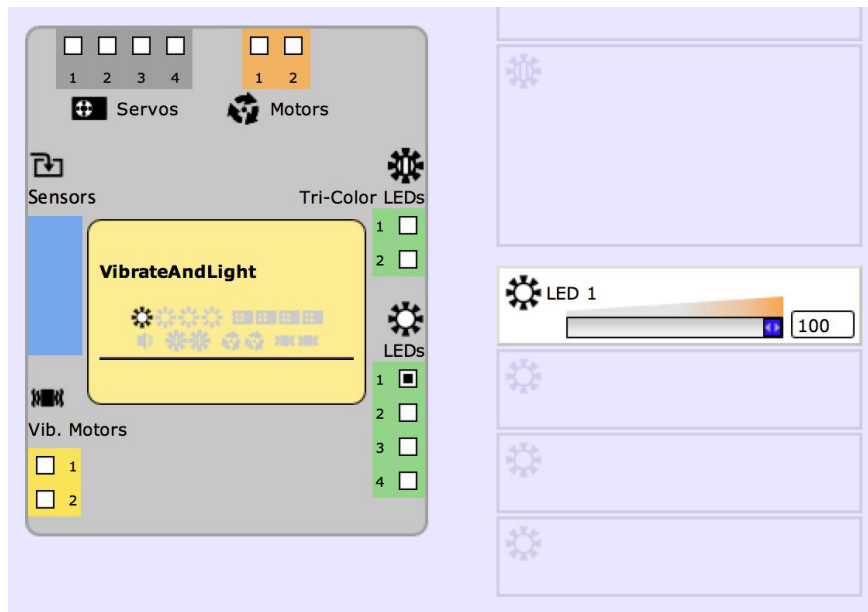


Exercise 5.1: As an example, the sequence below turns a motor on, uses a counter to blink some LEDs, and then turns the motor off.

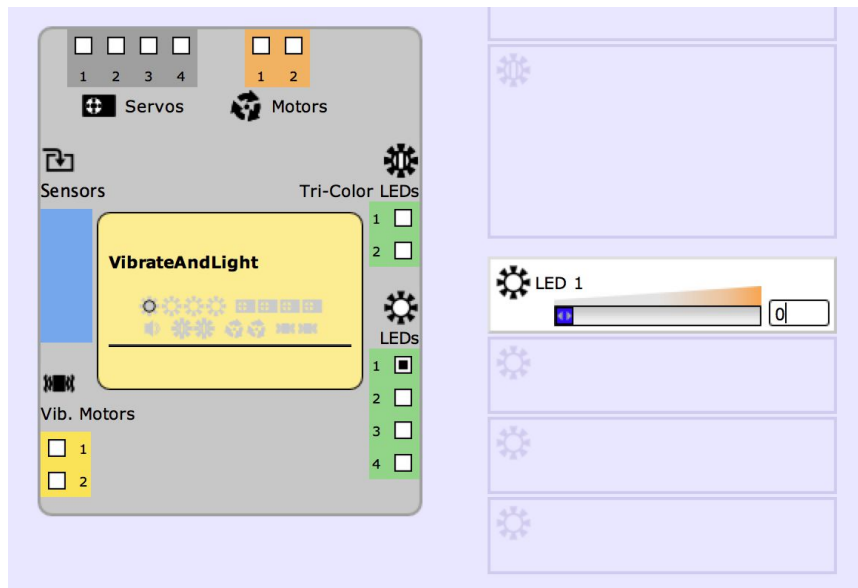


Exercise 5.2: Many possible solutions!

Exercise 6.1:
Expression for on



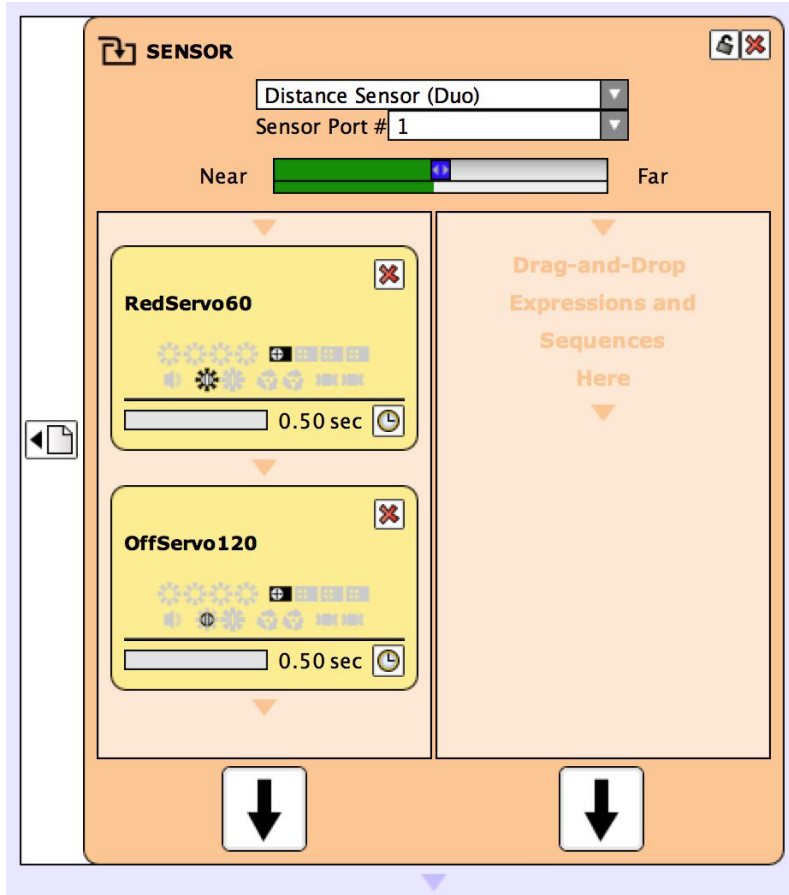
Expression for off



Exercise 6.2: If the student does not see the value of the distance sensor change, check to make sure that the **Sensor** block is set to the correct port.

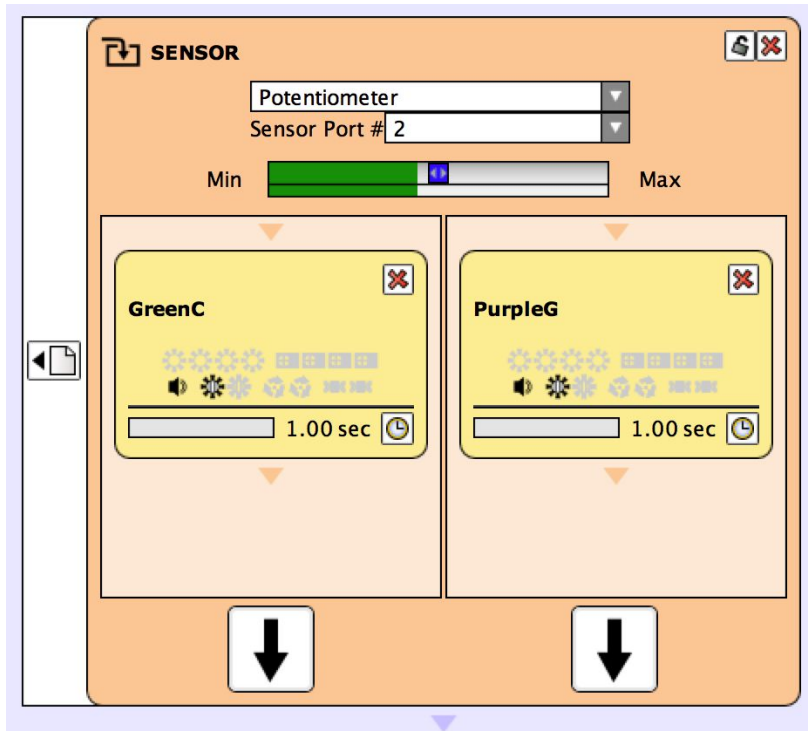
Exercise 6.3: The smallest possible wait time is 0 s. This will make the robot respond to the sensor as fast as possible. Depending on what you want to do, however, it may not be always possible to set the wait to 0. For example, Exercise 6.4 will require nonzero wait blocks.

Exercise 6.4: The RedServo60 expression turns a tri-color LED red and sets the servo to 60°. The OffServo120 expression turns the tri-color LED off and sets the servo to 120°. Some students may include an expression in the right side of the **Sensor** block to turn the LED off and set the servo to a constant angle, but this isn't necessarily required.

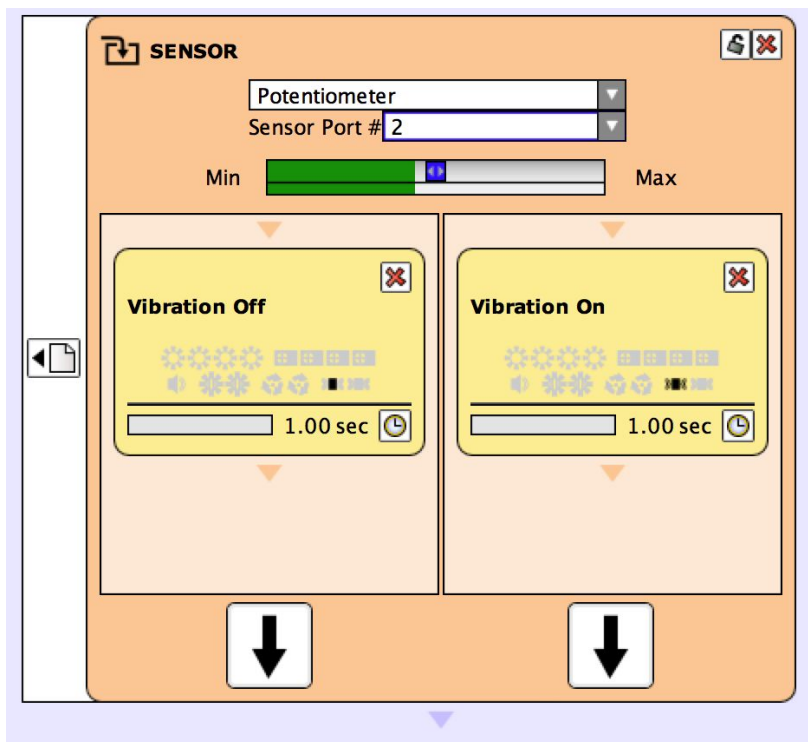


Exercise 7.1: If you hold the knob with the wires at the bottom, the green bar is at its smallest (Min) when it is turned all the way to the left and at its largest (Max) when it is turned all the way to the right.

Exercise 7.2: The expression GreenC plays a C note and turns the tri-color LED green. The expression PurpleG plays a G note and turns the tri-color LED purple.

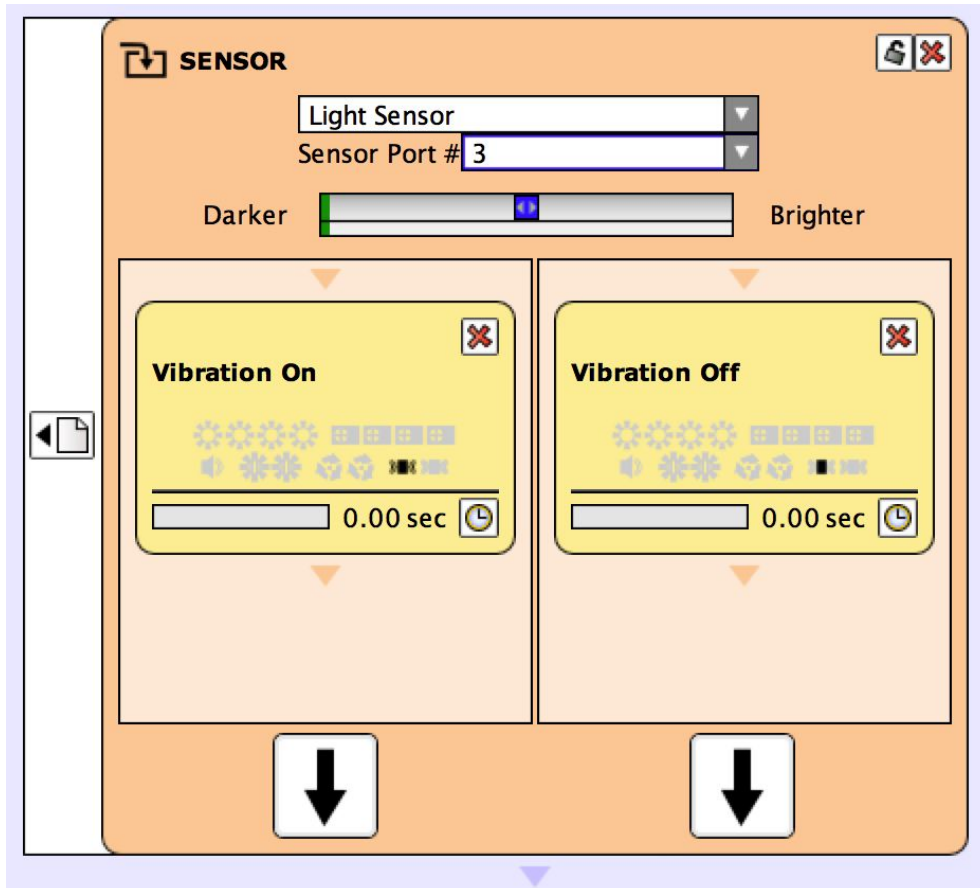


Exercise 7.3: The wait for each expression was set to 0 to make the sequence respond as quickly as possible to changes in the knob value.

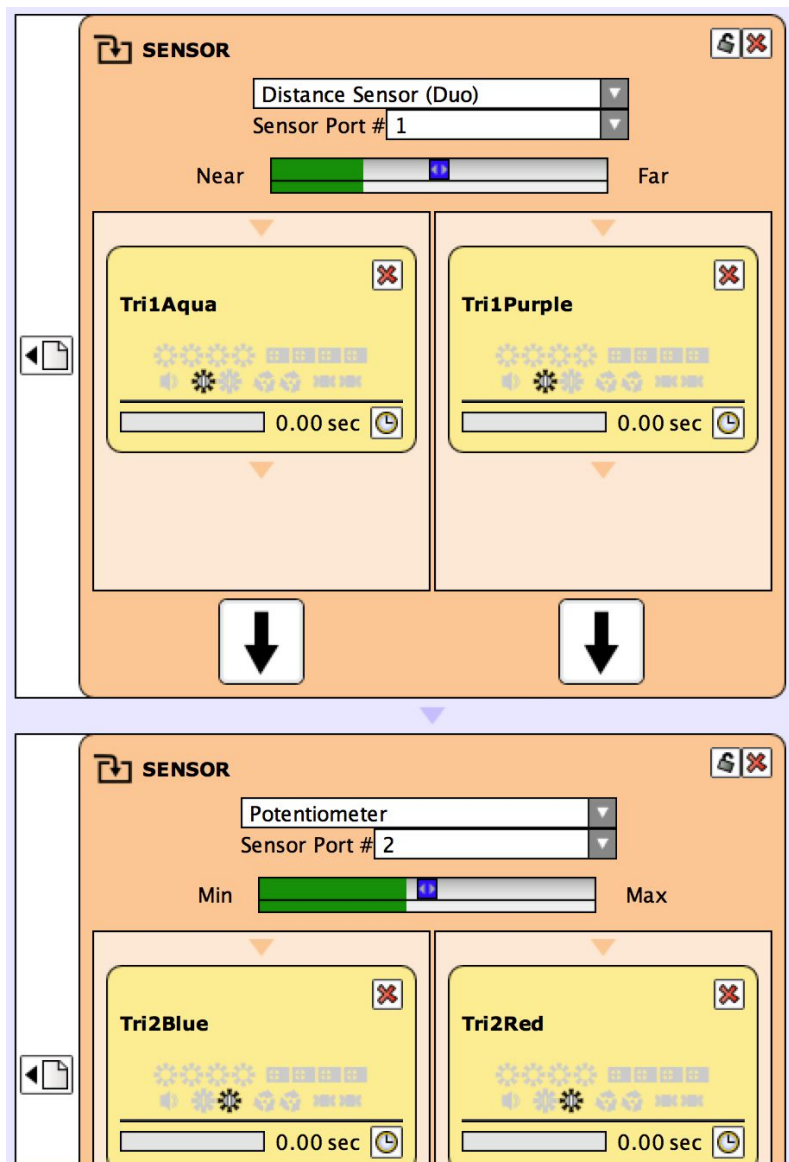


Exercise 8.1: Results will depend on your classroom, but most likely, students will need to drag the threshold toward the left. Make sure that they don't drag it so far that the green bar can't go below the threshold.

Exercise 8.2:



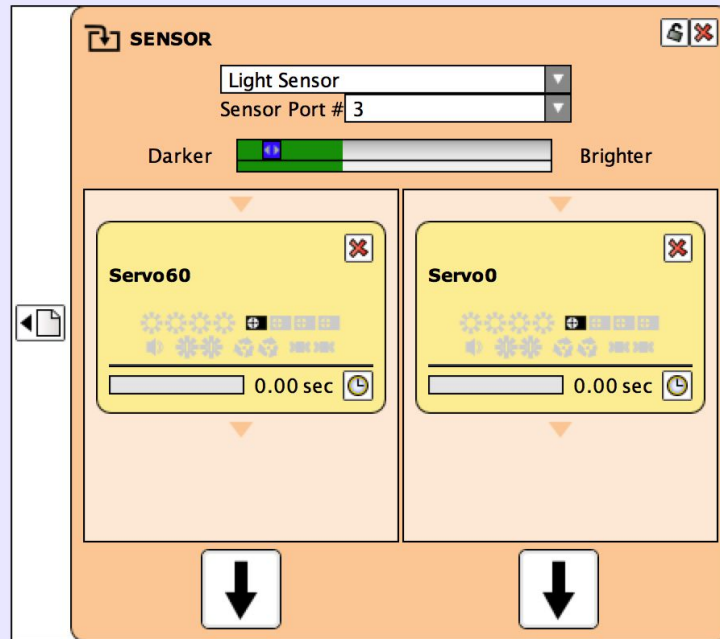
Exercise 9.1:



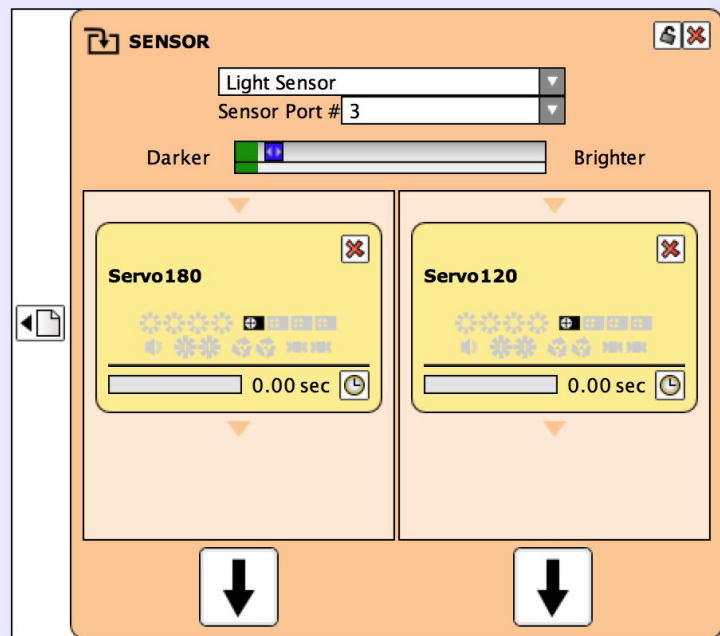
Exercise 9.2: When the distance sensor is above the threshold, turn the knob to right to turn on the vibration motor. When the distance sensor is below the threshold, cover the light sensor to turn on the vibration motor.

Exercise 9.3:
Light Sensor Sequences

Light0-60



Light120-180



Distance Sensor Sequence

