Studuino
Gyroscope

Manual

This manual explains the Studuino Programming Environment and how to use it. As the Studuino Programming Environment develops, this manual may be edited or revised. You can find the full manual below.

■ Installing Studuino Software
http://artec-kk.co.jp/studuino/docs/en/Studuino_setup_software.pdf

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1. 1. About Your Gyroscope

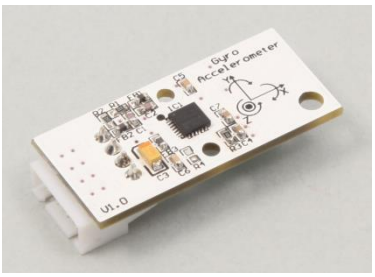
1.1. Overview

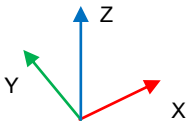
Your Gyroscope is an InvenSense MPU-6050, which combines a three-axis gyroscope and three-axis accelerometer module.

1.2. Specifications

Sensor	MPU-6050
Operating Voltage	2.4-3.4 V
Interface	I2C
Gyroscope	Three-axis at ±250, ±500, ±1000, and ±2000dps (±250dps by default)
Acceleration	Three-axis at ±2g, ±4g, ±8g, ±16g (default ±2g)

X, Y, and Z axes are written on the circuit board.





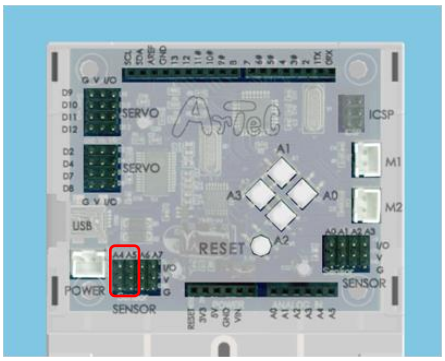
2. Connecting to Studuino

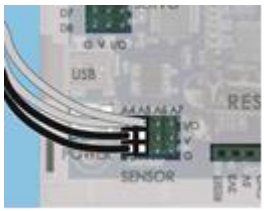
① Use the four-wire 50 cm connecting cable (product 153127, sold separately).

② The white end of the cable plugs into your Gyroscope, while the black end connects to your Studuino.

③ Your sensor uses both connectors A4 and A5 (though it will fit into other connectors, they cannot be used).
The gray signal wire should face inward.

Gyroscope





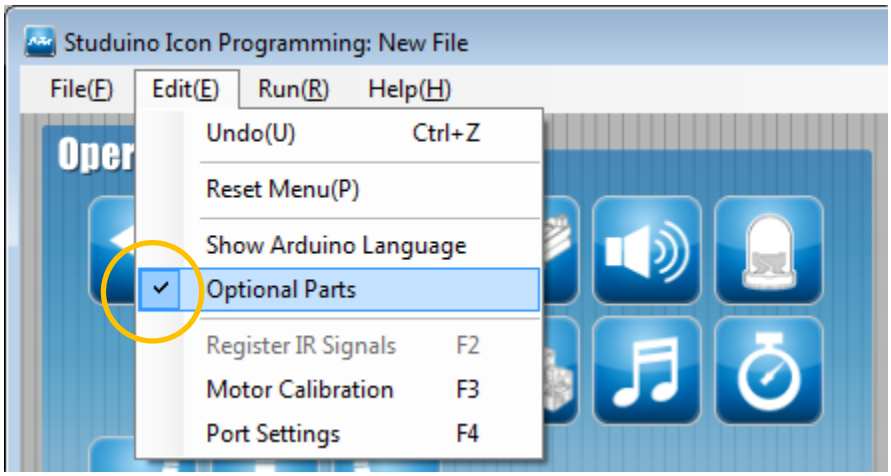
Make sure the cables are inserted correctly!

Use the four-wire cable with connectors A4 and A5.

3. In the Studuino Icon Programming Environment

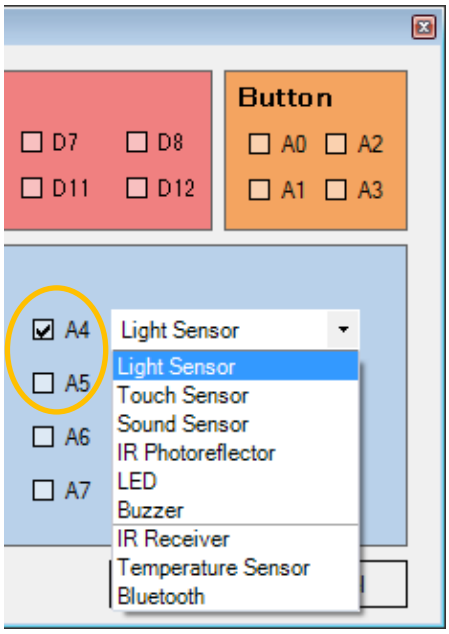
Familiarize yourself with the basics of the Studuino Programming Environment by reading the Studuino Programming Environment Manual and the Icon Programming Environment Guide.

From the Edit menu click Optional Parts. A check will appear beside this option when enabled.

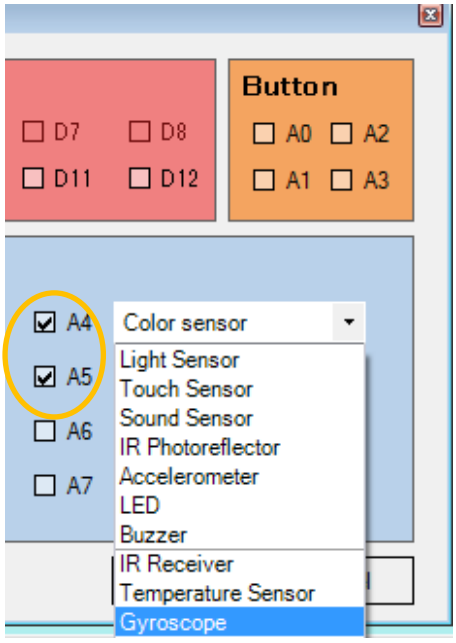


Enabled when checked

Your Gyroscope uses the I2C port (A4, A5). Under Port Settings check the boxes for ports A4 and A5 in the Sensor / LED / Buzzer section. You will need to check both of these boxes to use the sensor.

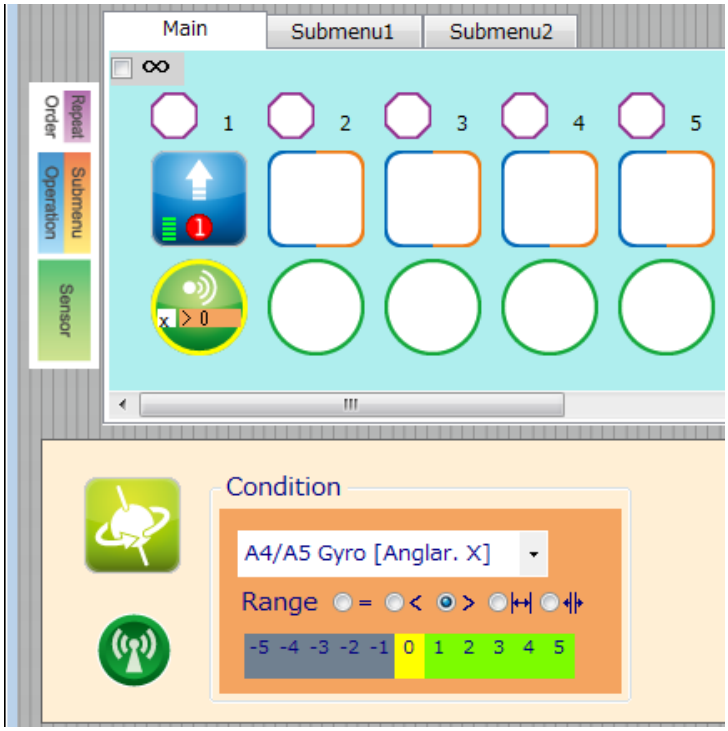


Unavailable when only A4 is checked



Available when both boxes are checked

Drag and drop the icons shown below and choose one of the six A4/A5 Gyroscope (***) conditions. These conditions use the acceleration and angular velocity of the X, Y, and Z axes.



3.1. Using the Sensor Viewer

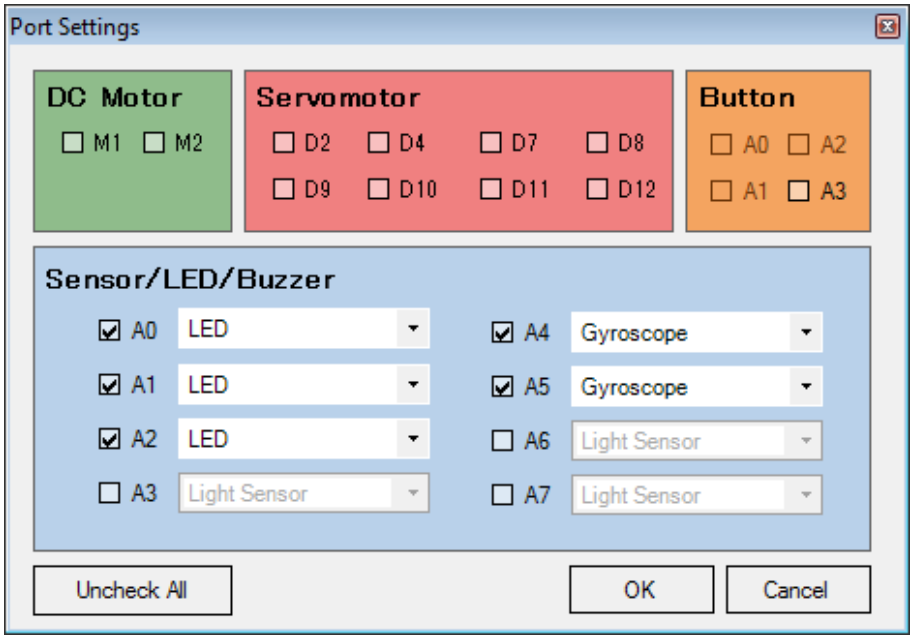
The Sensor Viewer shows a range of -5 to 5 (a total of 11 values) for each condition. Acceleration values have a range of ±2 g (g = gravitational acceleration = 9.8[m/s^2]) and angular velocity values have a range of ±250 [dps] (degrees(°) per second).

3.2. Sample Program

Familiarize yourself with the basics of the Studuino Programming Environment by reading the Studuino Programming Environment Manual and the Icon Programming Environment Guide.

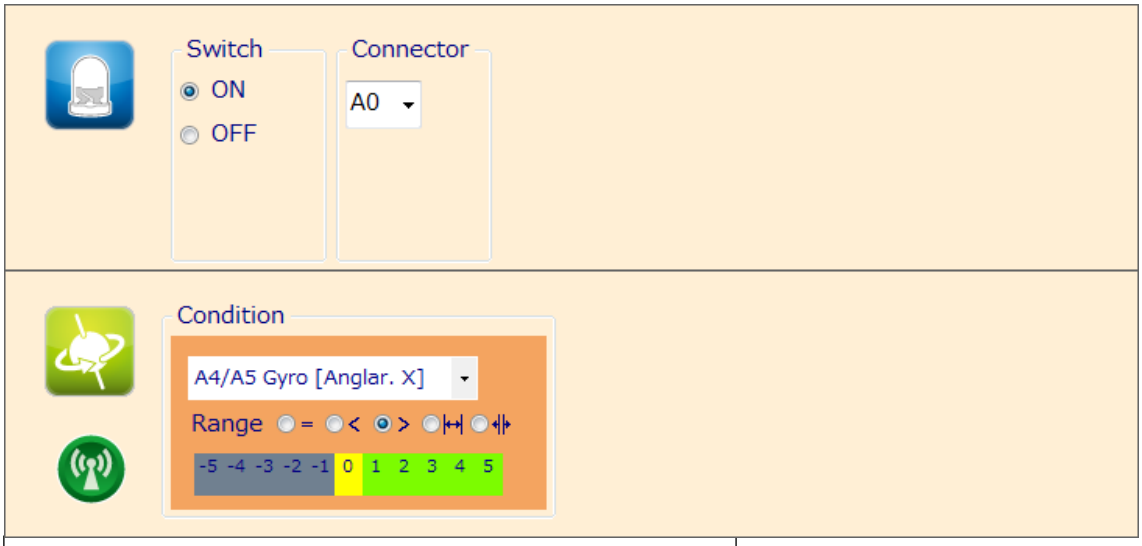
This section shows you how to make a program which flashes a different number of LEDs depending on how quickly the Gyroscope is spun on its X axis.

① Set the Port Settings as shown below.



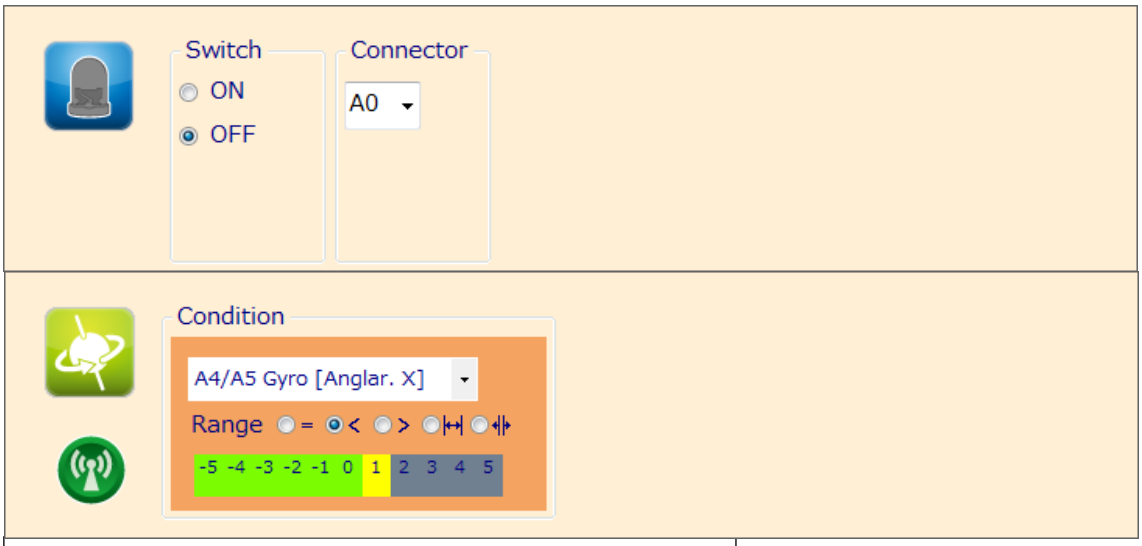
② Check the Repeat Indefinitely box, place icons, and set them as shown below.

No. 1



Action: LED, Switch ON, Connector A0

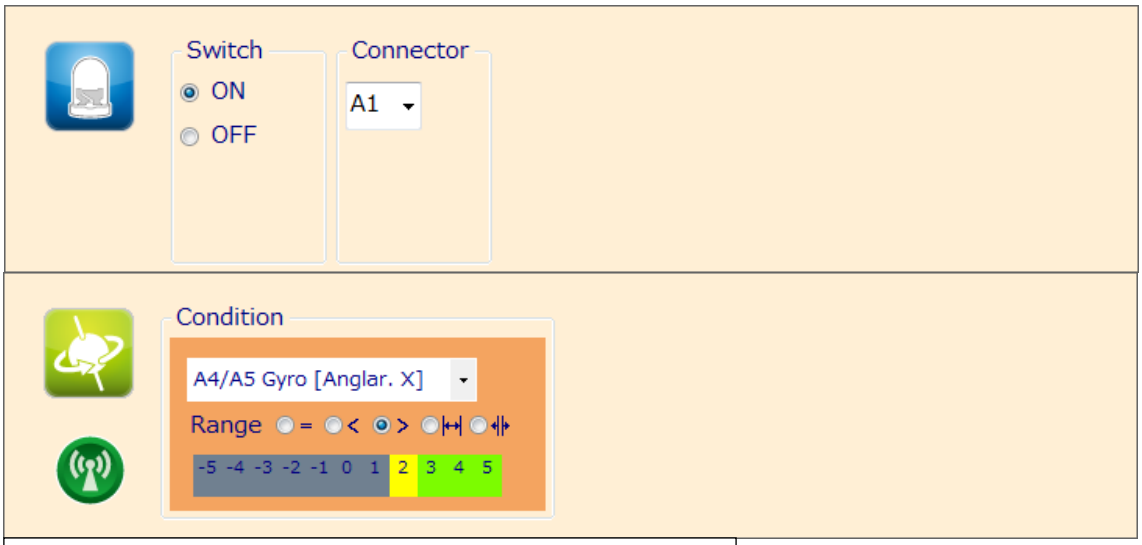
Condition: Gyro [Anglar. X] > 0



Connector A0

Condition: Gyro [Anglar. X] < 1

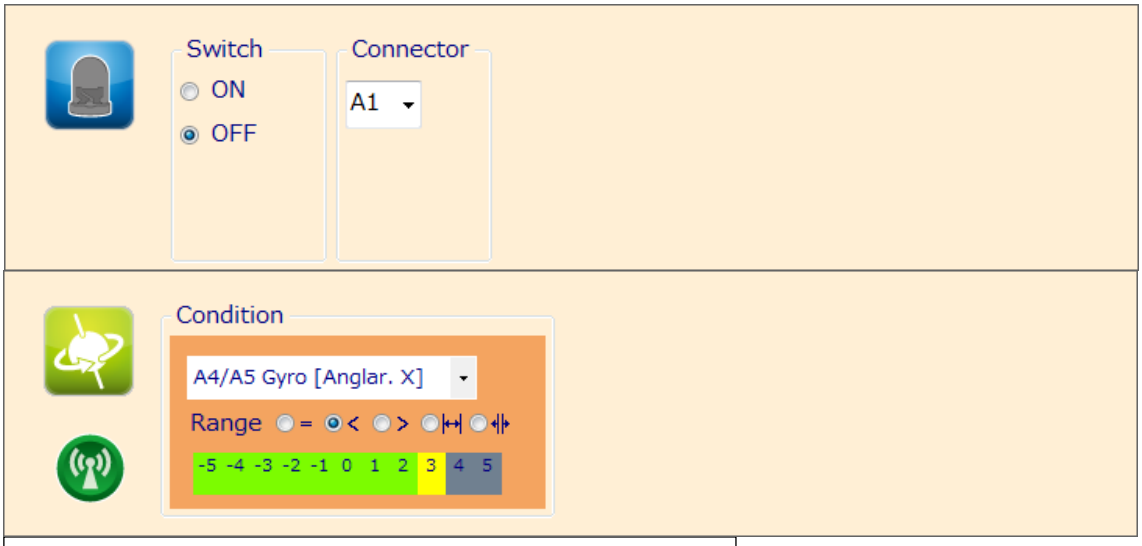
No. 3



Action: LED, Switch ON, Connector A1

Condition: Gyro [Anglar. X] > 2

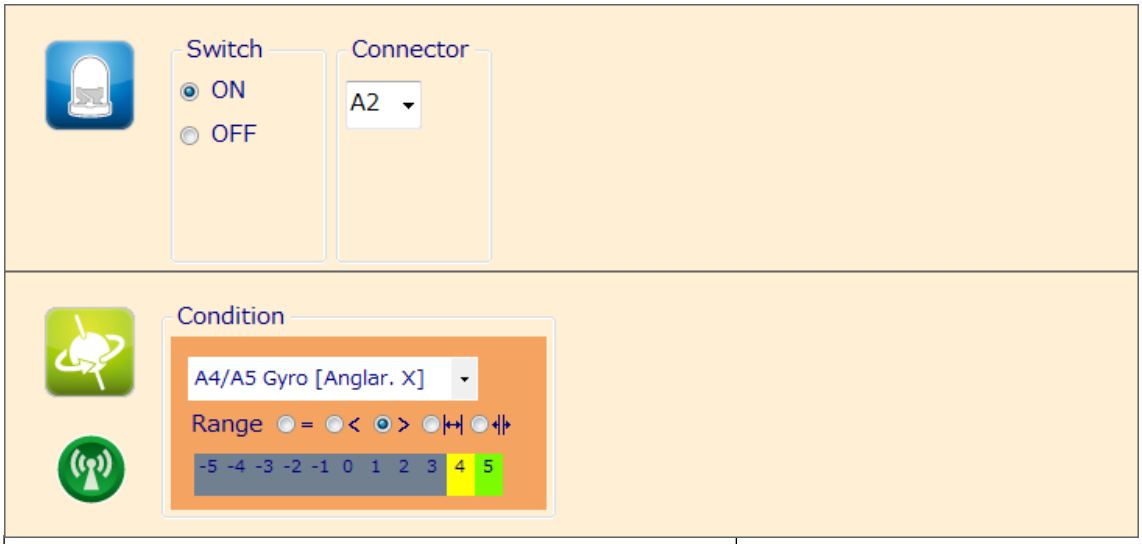
No. 4



Action: LED, Switch OFF, Connector A1

Condition: Gyro [Anglar. X] < 3

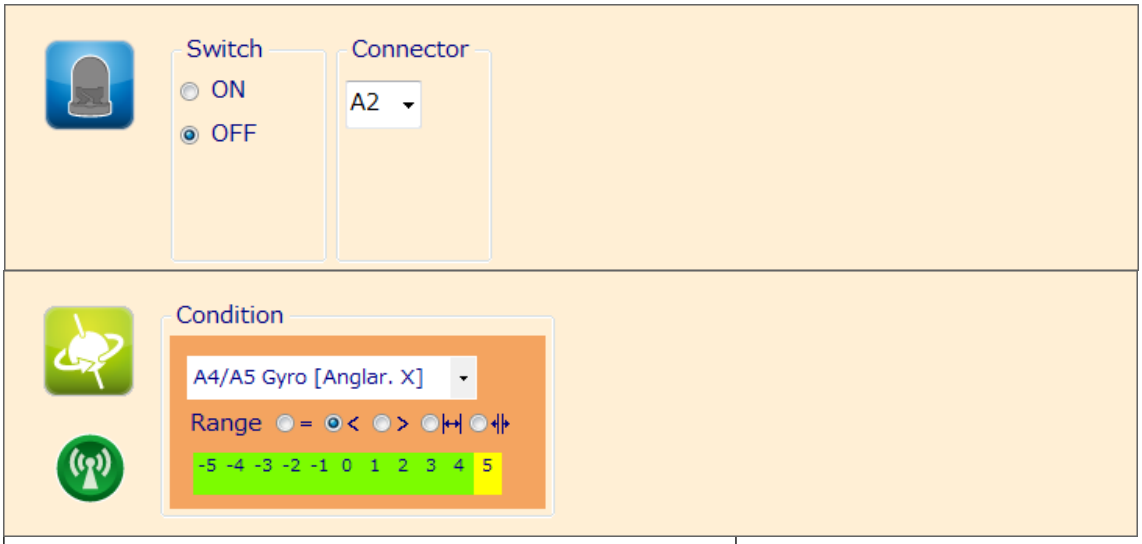
No. 5



Action: LED, Switch ON, Connector A2

Condition: Gyro [Anglar. X] > 4

No. 6No. 2



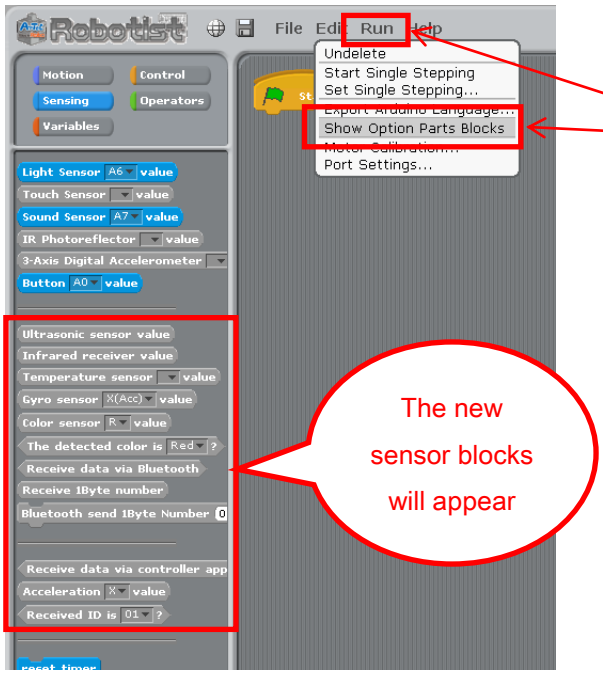
Action: LED, Switch OFF, Connector A2

Condition: Gyro [Anglar. X] < 5Action: LED, Switch OFF,

4. In the Studuino Block Programming Environment

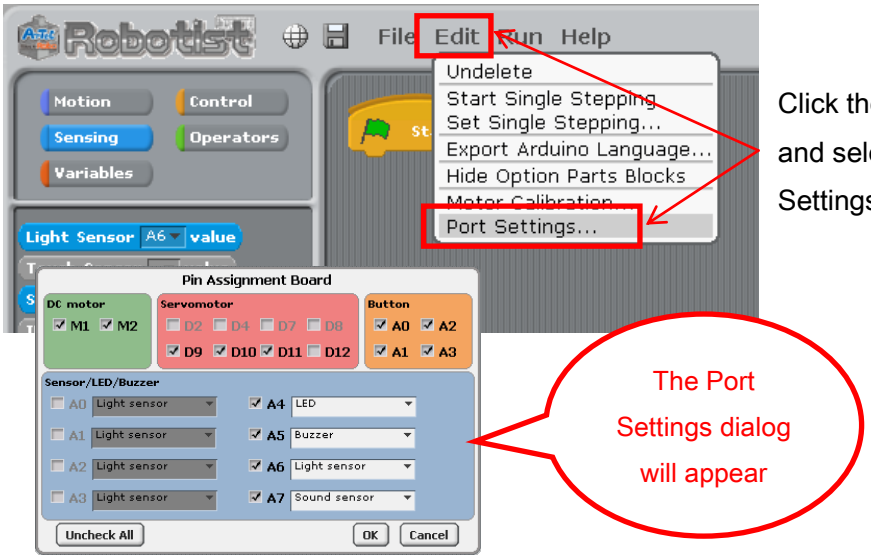
To use your Gyroscope in the Block Programming Environment you will need to make sure the Gyroscope block is available and active. Follow the steps below to do this:

① From the Edit menu, choose Show Optional Parts to display the new sensor blocks.



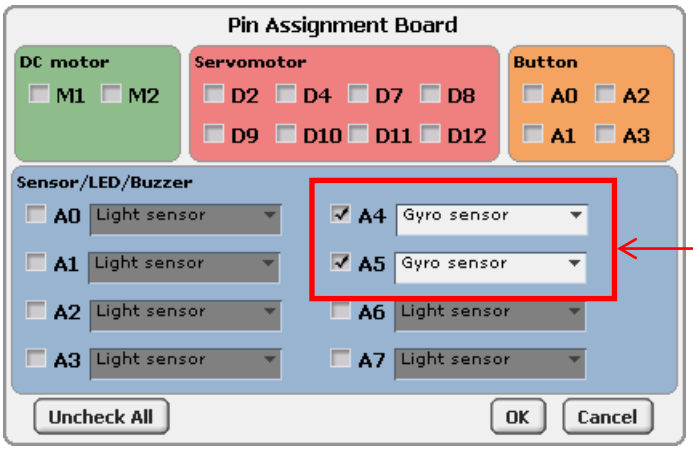
Click the Edit menu and select Show Optional Parts

② Click the Edit menu and choose Port Settings... to open the Port Settings dialog.



Click the Edit menu and select Port Settings...

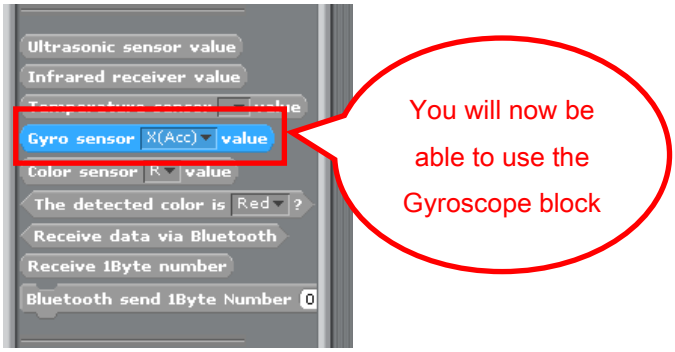
③ Under the Sensor / Buzzer / LED section of the Port Settings dialog, check boxes A4 and A5 and use the combo box to select the Gyroscope. Click OK.



Choose Gyroscope for A4 and A5

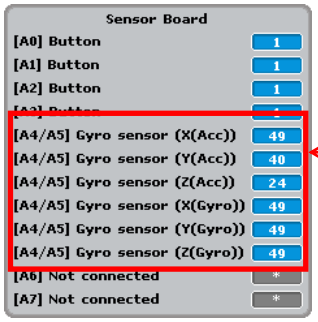
★ Programs made in the Block Programming Environment which use both an Infrared Receiver and I2C device (Accelerometers, Gyroscopes, or Color Sensors) are too large for your Studuino's memory. The below message will appear if you attempt to select both an Infrared Receiver and an I2C device in the Port Settings dialog.

④ The Gyroscope block will become active.



4.1. Gyroscope Values

Your Gyroscope detects changes in its slope and acceleration along the X, Y and Z axes. The Gyroscope block returns these values as whole numbers from 0-100. You can check these values using the Sensor Board in Test mode.



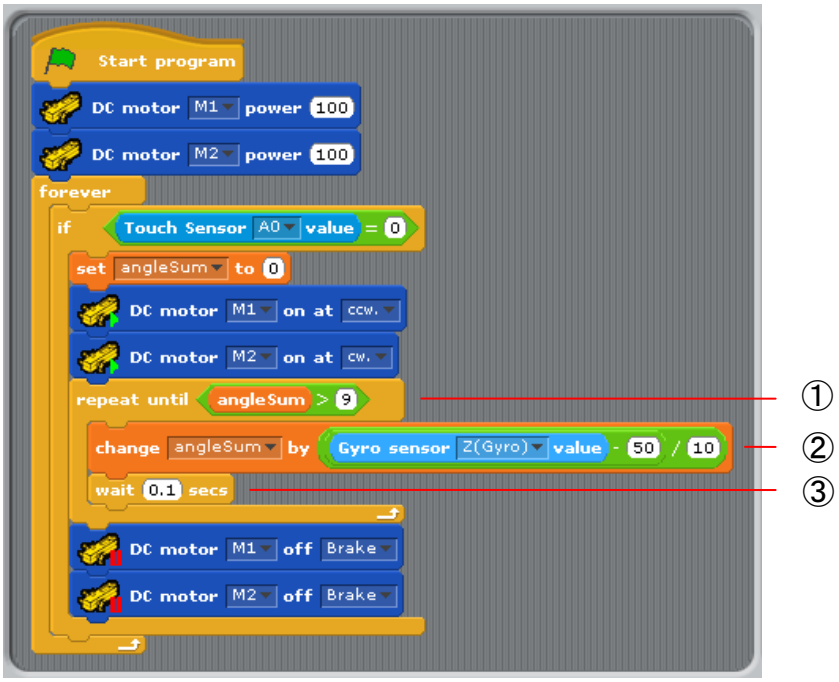
Shows slope and acceleration

In the Sensor Board, (Acceleration X-Z) shows the detected slope and (AngVec X-Z) shows the detected angular velocity.

4.2. Sample Program Using the Gyroscope

The picture below shows an example program using a Gyroscope.

This program makes a twin-DC Motor car robot turn 45° when you press the switch on the touch sensor.



A measurement is taken every tenth of a second, and those tenths are added together to calculate how far your robot has turned.

① The value from your Gyroscope is 50 at 0 dps and 100 at +250 dps. You can find the value of a single dps by using the formula (100 - 50) / 250, which equals 0.2. The formula used to find the value of a 45° turn becomes 0.2 * 45, which equals 9.

② The 0 dps value of 50 is subtracted from Gyroscope measurement. This measurement is in dps, or degrees per second. This example uses milliseconds, which means the value must be divided by 10.

③ Due to the time it takes to process steps ① and ②, inserting a wait 0.1 sec. block means the total measurement takes longer than 0.1 seconds to calculate. In order to get an accurate measurement, the value you give this block should be slightly lower than 0.1.