

Stduino Gyroscope Manual



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

■ Installing Stduino Software

http://artec-kk.co.jp/stduino/docs/en/Stduino_setup_software.pdf

Index

1.	1. About Your Gyroscope	1
1.1.	Overview	1
1.2.	Specifications	1
2.	Connecting to Studuino	1
3.	In the Studuino Icon Programming Environment	3
3.1.	Using the Sensor Viewer	5
3.2.	Sample Program	6
4.	In the Studuino Block Programming Environment	10
4.1.	Gyroscope Values.....	12
4.2.	Sample Program Using the Gyroscope	12

1. 1. About Your Gyroscope

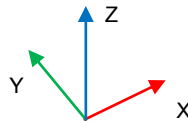
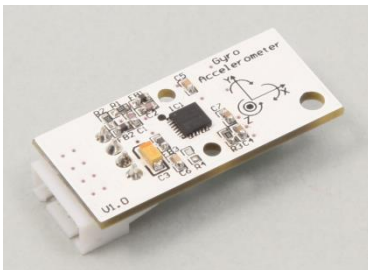
1.1. Overview

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 ± 2000 dps (± 250 dps by default)
Acceleration	Three-axis at $\pm 2g$, $\pm 4g$, $\pm 8g$, $\pm 16g$ (default $\pm 2g$)

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



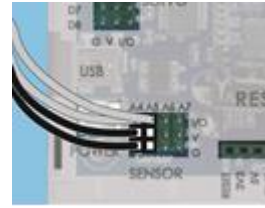
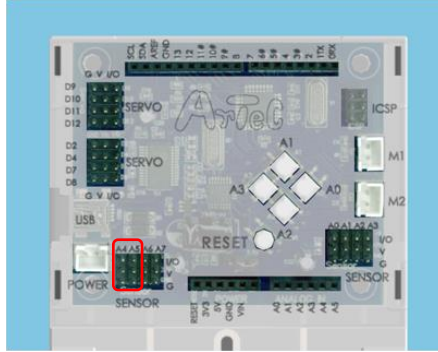
2. Connecting to Studuino

- 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



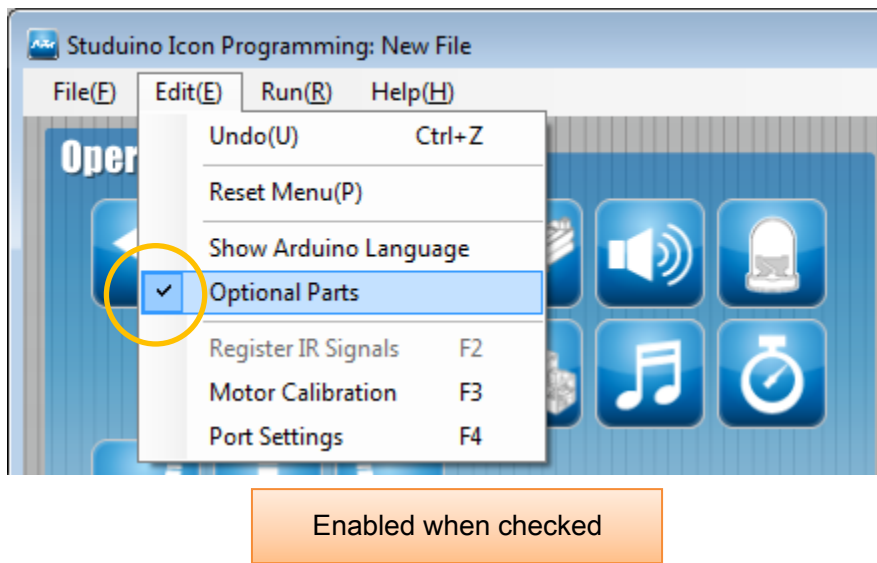
Make sure the cables are inserted correctly!

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

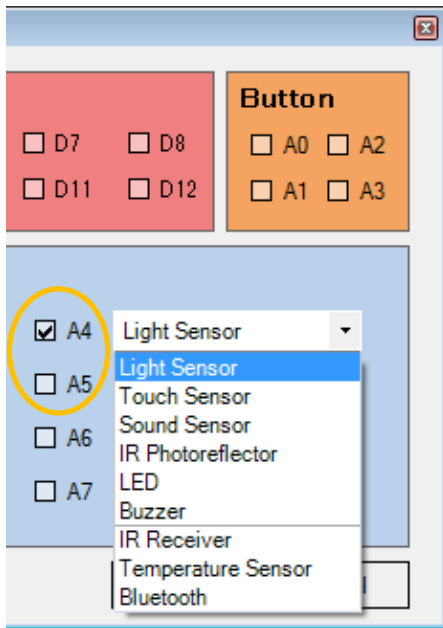
3. In the Studuino Icon Programming Environment

Familiarize yourself with the basics of the Studuino Programming Environment by reading the [Studuino Programming Environment Manual](#) and the [Icon Programming Environment Guide](#).

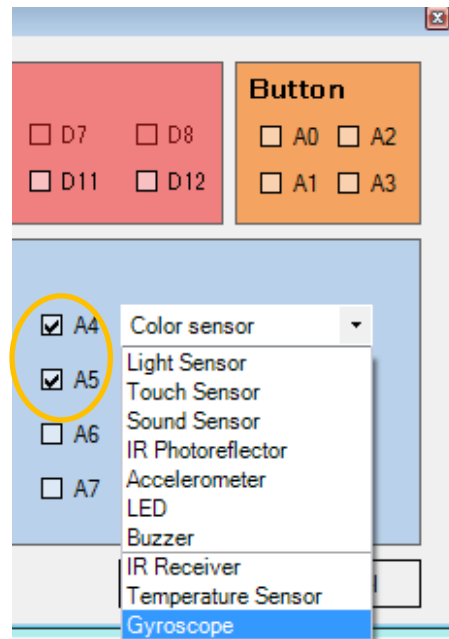
From the Edit menu click Optional Parts. A check will appear beside this option when enabled.



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.

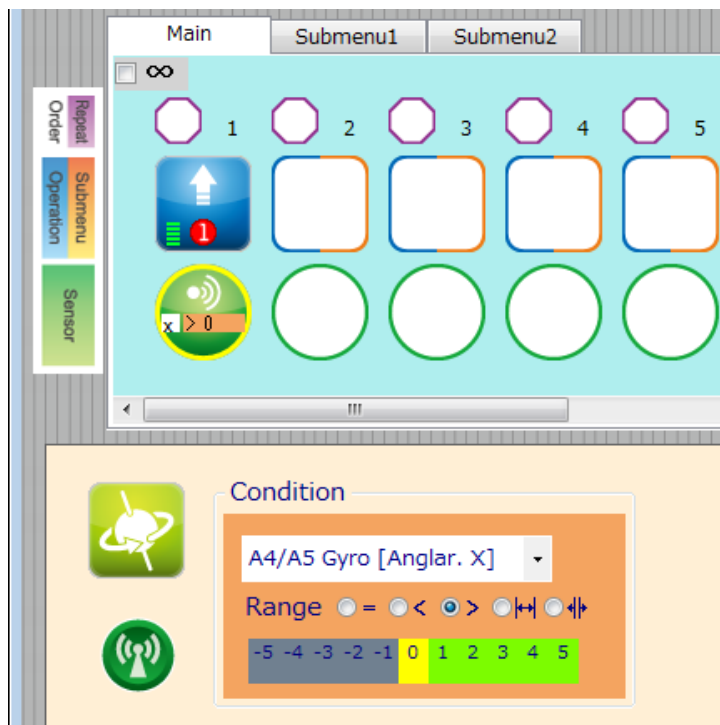


Unavailable when only A4 is checked

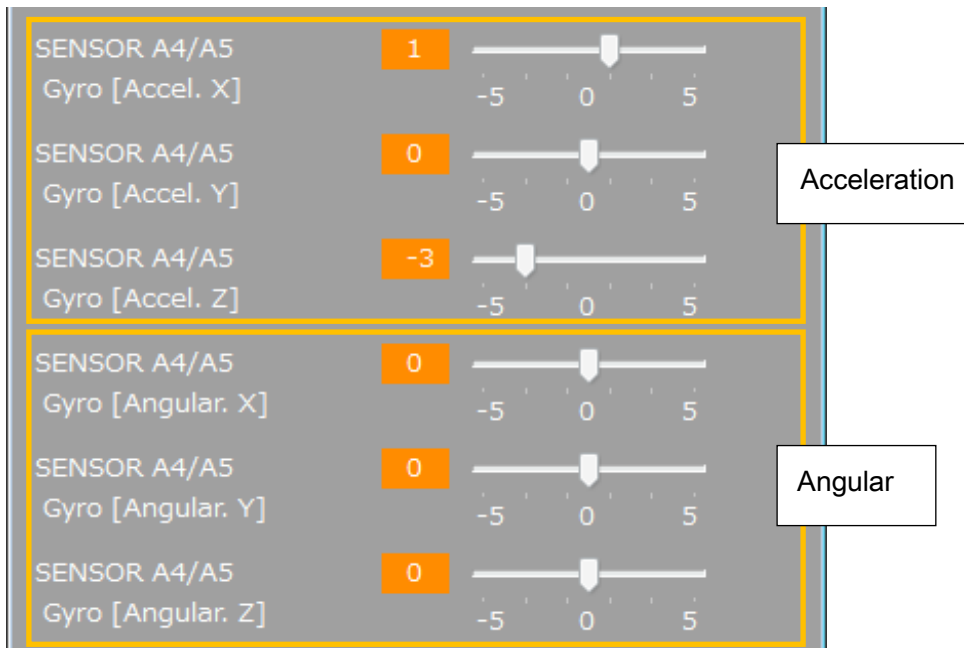


Available when both boxes are checked

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



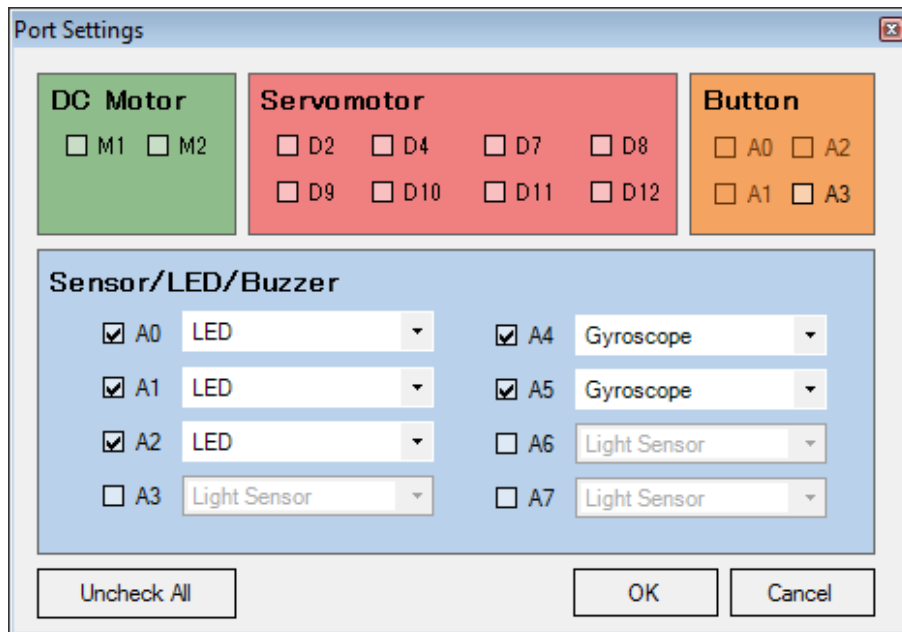
The Sensor Viewer shows a range of -5 to 5 (a total of 11 values) for each condition. Acceleration values have a range of ± 2 g ($g = \text{gravitational acceleration} = 9.8[\text{m/s}^2]$) and angular velocity values have a range of ± 250 [dps] (degrees($^\circ$) per second).

3.2. Sample Program

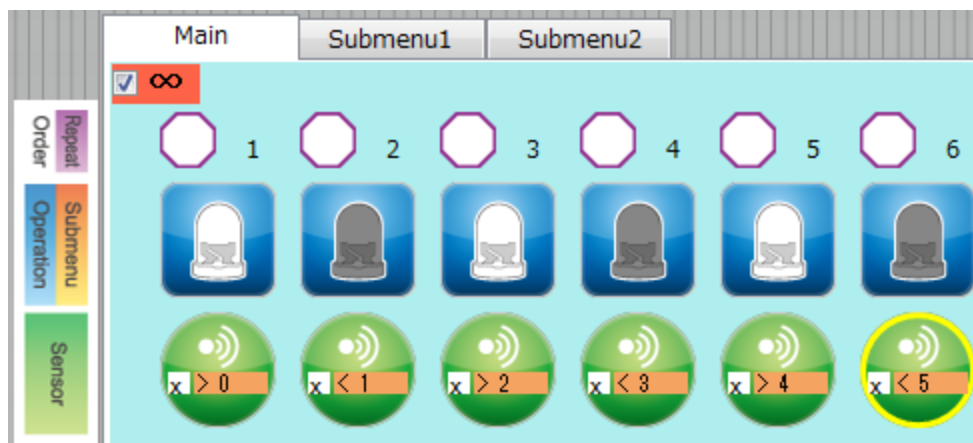
Familiarize yourself with the basics of the Studuino Programming Environment by reading the [Studuino Programming Environment Manual](#) and the [Icon Programming Environment Guide](#).

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


 **Switch**
 ON
 OFF

Connector
A0 ▾


 **Condition**
A4/A5 Gyro [Anglar. X] ▾
Range = < > <= >=

-5 -4 -3 -2 -1 0 1 2 3 4 5

Action: LED, Switch ON, Connector A0
Condition: Gyro [Anglar. X] > 0

 **Switch**
 ON
 OFF


Connector
A0 ▾

 **Condition**
A4/A5 Gyro [Anglar. X] ▾
Range = < > <= >=


-5 -4 -3 -2 -1 0 1 2 3 4 5

Connector A0
Condition: Gyro [Anglar. X] < 1

No. 3

 **Switch**
 ON
 OFF


Connector
A1 ▾

 **Condition**
A4/A5 Gyro [Anglar. X] ▾
Range = < > |<|> |<|>|


-5 -4 -3 -2 -1 0 1 2 3 4 5

Action: LED, Switch ON, Connector A1
Condition: Gyro [Anglar. X] > 2

No. 4

 **Switch**
 ON
 OFF

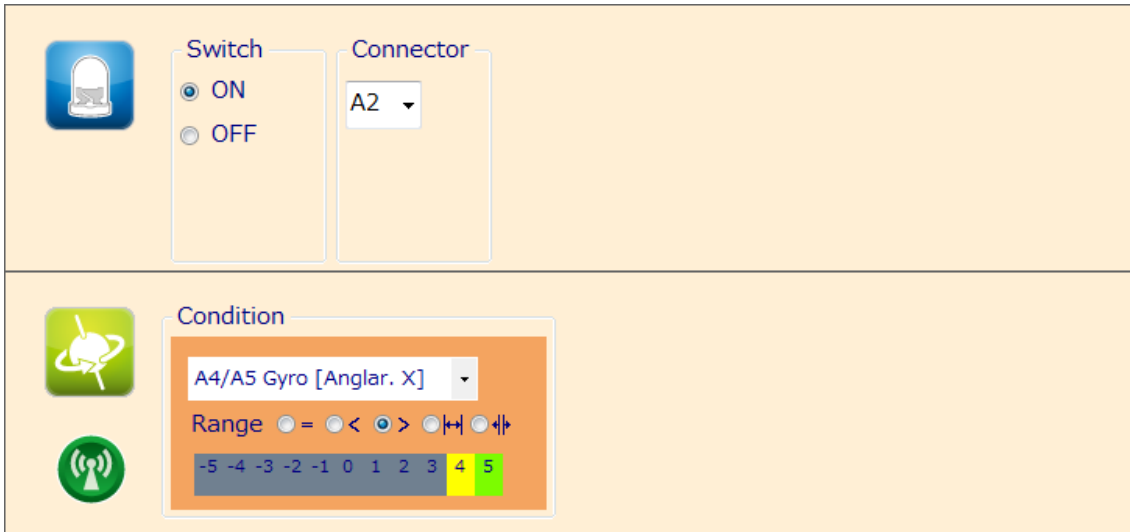
Connector
A1 ▾

 **Condition**
A4/A5 Gyro [Anglar. X] ▾
Range = < > |<|> |<|>|


-5 -4 -3 -2 -1 0 1 2 3 4 5

Action: LED, Switch OFF, Connector A1
Condition: Gyro [Anglar. X] < 3

No. 5

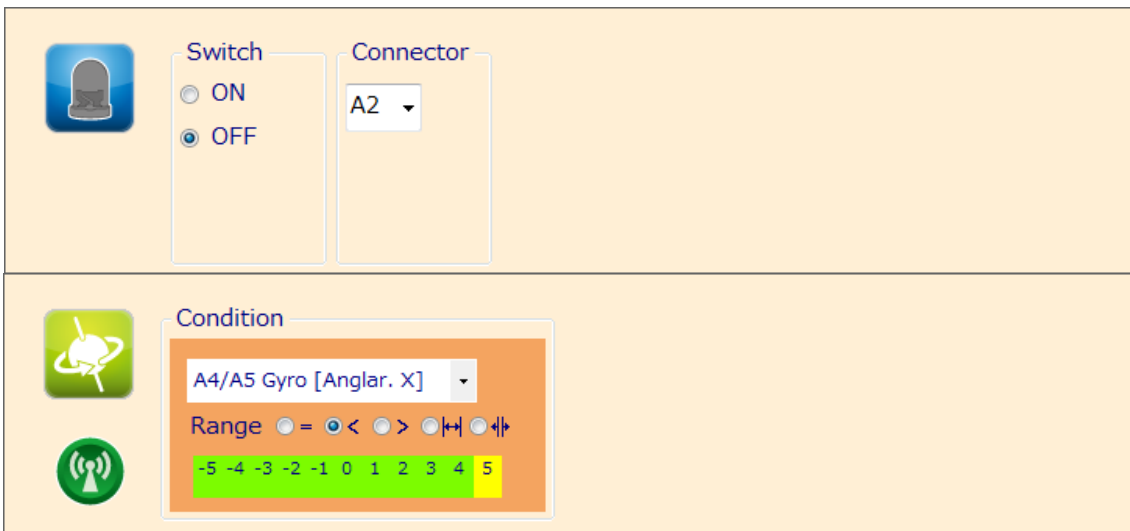
 **Switch**
 ON
 OFF

Connector
A2


 **Condition**
A4/A5 Gyro [Anglar. X]
Range = < > <= >= <= < >= >
-5 -4 -3 -2 -1 0 1 2 3 4 5

Action: LED, Switch ON, Connector A2
Condition: Gyro [Anglar. X] > 4

No. 6No. 2

 **Switch**
 ON
 OFF

Connector
A2

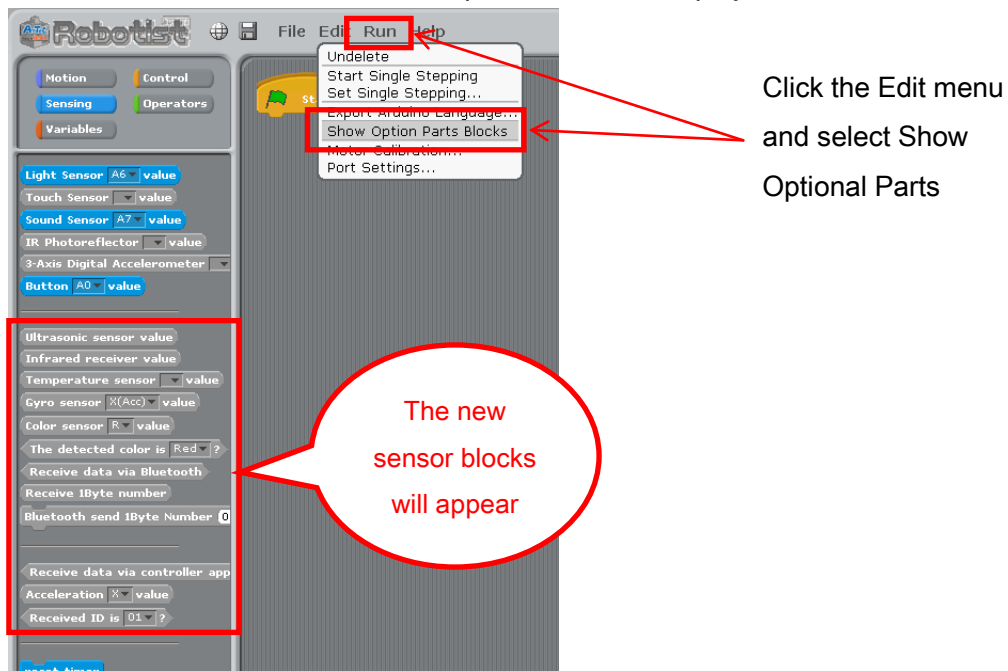
 **Condition**
A4/A5 Gyro [Anglar. X]
Range = < > <= >= <= < >= >
-5 -4 -3 -2 -1 0 1 2 3 4 5

Action: LED, Switch OFF, Connector A2
Condition: Gyro [Anglar. X] < 5
Action: LED, Switch OFF,

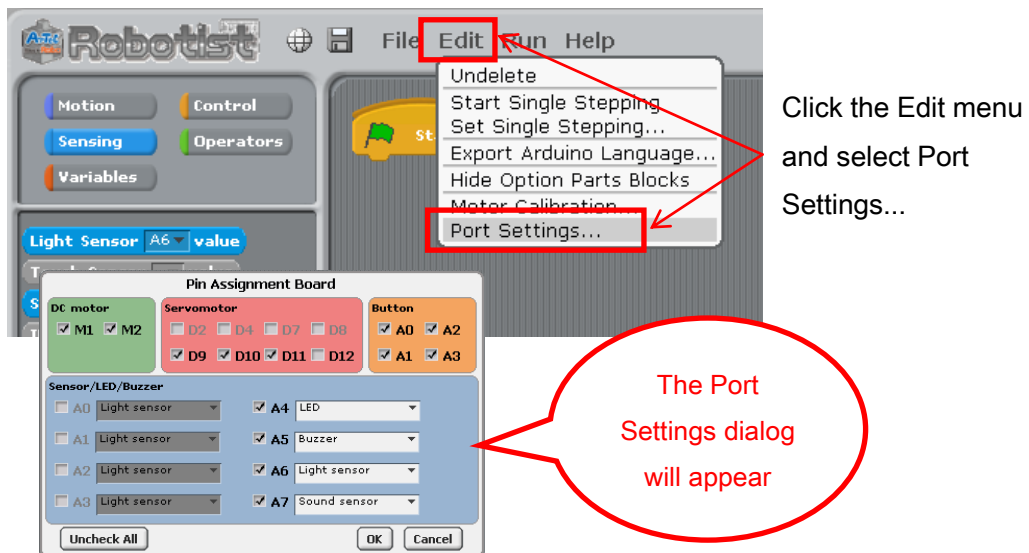
4. In the Studuino Block Programming Environment

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:

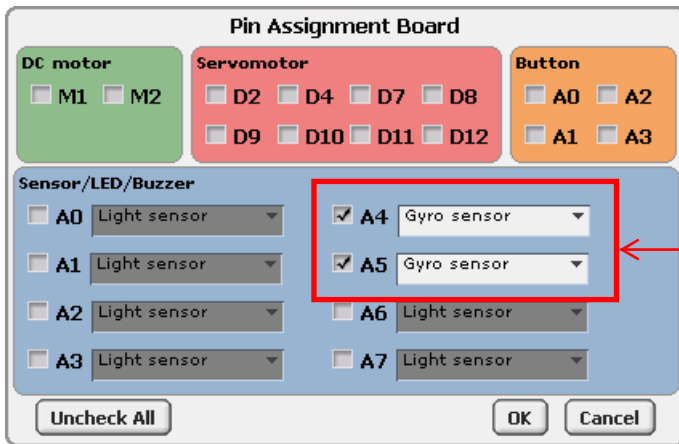
- ① From the Edit menu, choose Show Optional Parts to display the new sensor blocks.



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



- 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.

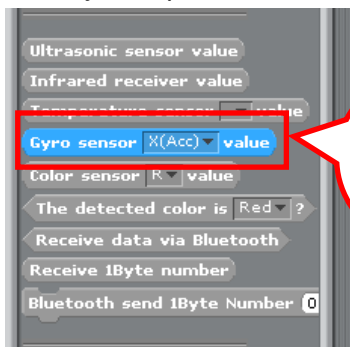


Choose Gyroscope for A4 and A5

★ 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.



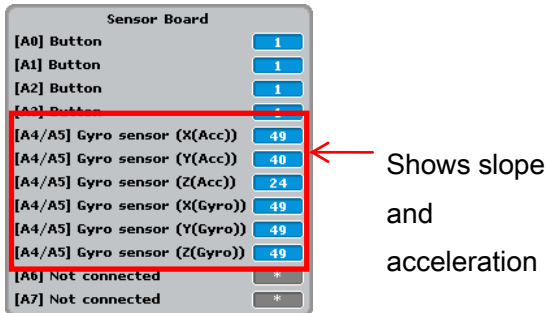
- ④ The Gyroscope block will become active.



You will now be able to use the Gyroscope block

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.

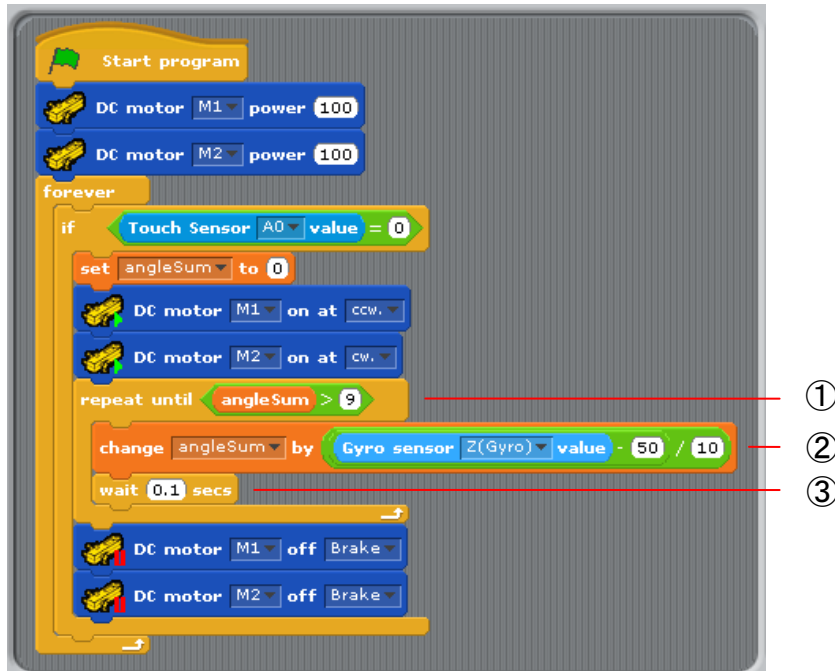


In the Sensor Board, (Acceleration X-Z) shows the detected slope and (AngVec X-Z) shows the detected angular velocity.

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.