

Get going

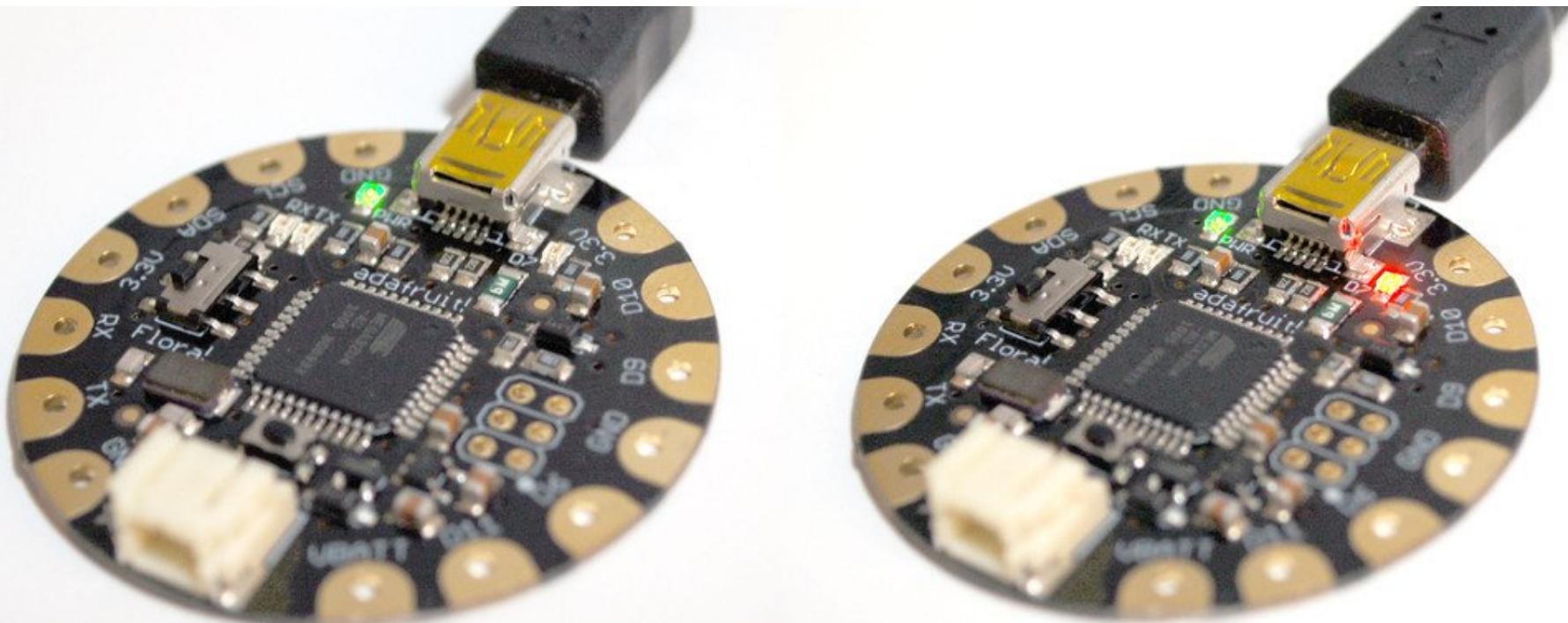
- In the IDE goto:

Tools > Board > Adafruit Flora

Tools > Port > COM[!]

- If you're using a Windows computer, it will be named COMsomething, but not COM1 or COM2 (so it will be whatever comes after those two if they exist, such as COM3 or COM4).
- "usbmodem" if you have a Mac.

Flora – Blinky Hello Word



Code :-

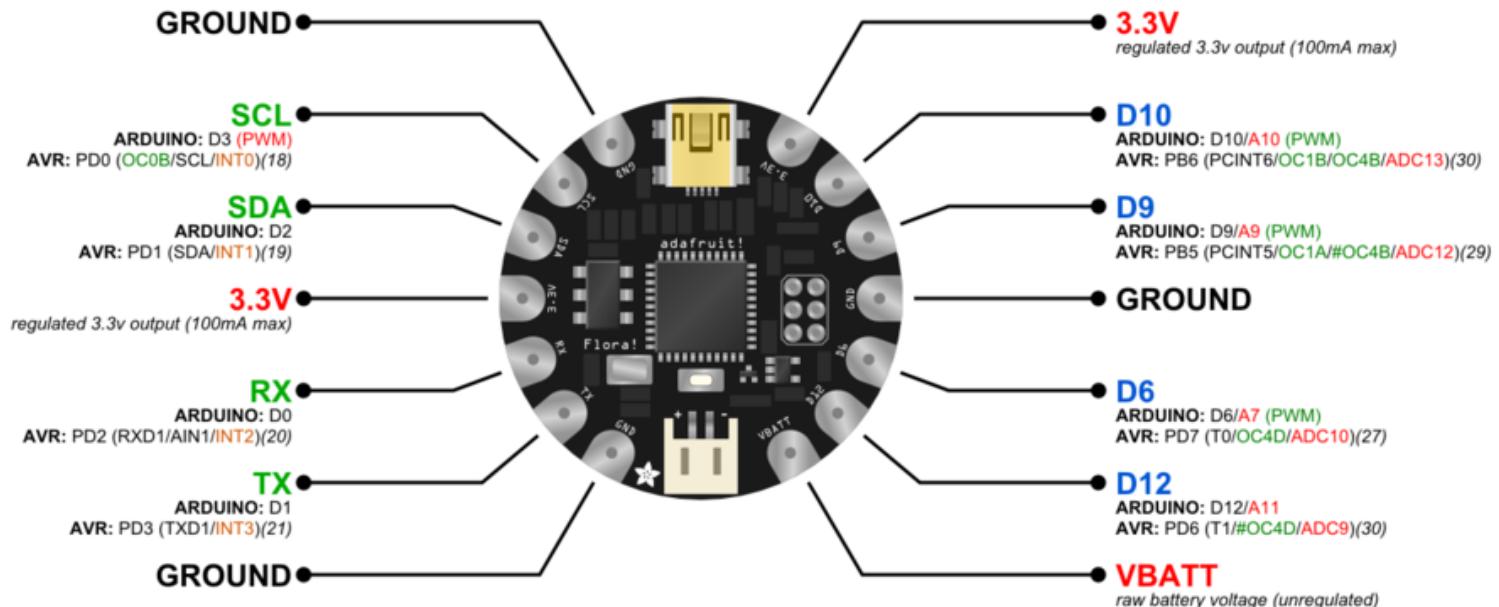
https://raw.githubusercontent.com/JohnMechatronics/Wearable_Electronics/master/Flora_Blinky.ino



Flora_Blinky

```
// Pin D7 has an LED connected on FLORA.  
// give it a name:  
int led = 7;  
  
// the setup routine runs once when you press reset:  
void setup() {  
    // initialize the digital pin as an output.  
    pinMode(led, OUTPUT);  
}  
  
// the loop routine runs over and over again forever:  
void loop() {  
    digitalWrite(led, HIGH);      // turn the LED on (HIGH is the voltage level)  
    delay(1000);                // wait for a second  
    digitalWrite(led, LOW);       // turn the LED off by making the voltage LOW  
    delay(1000);                // wait for a second  
}
```

FLORA pinout diagram



FLORA Wearable Electronics Platform
adafruit.com/products/659

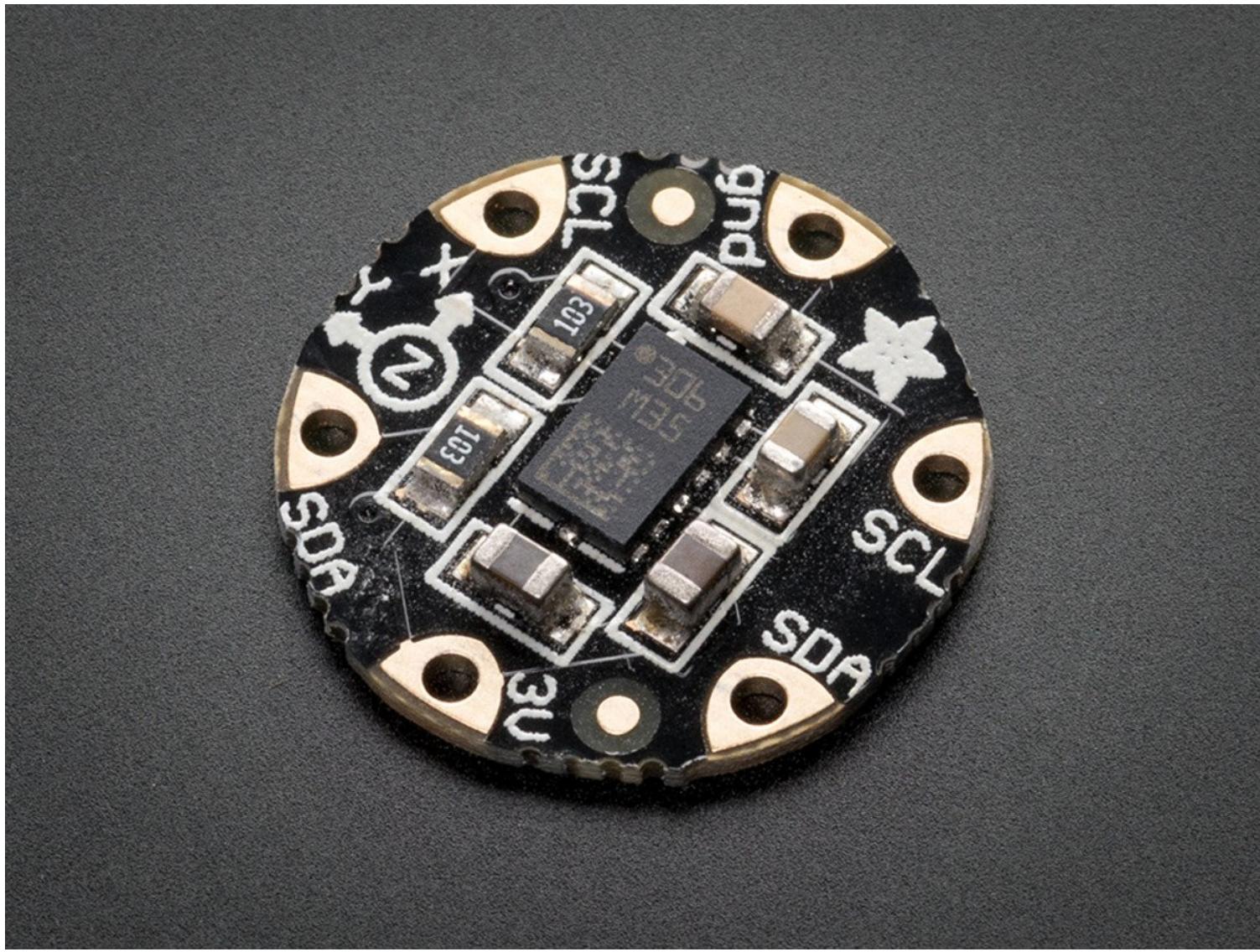
drawing 2012 by J. M. DeCristofaro -- CC-BY-SA 3.0

i2c bus

- Flora's I2C allows you to communicate with I2C / TWI devices.
- Using the SDA (data line) and SCL (clock line).
- I2C compatible devices can be chained allowing multiple devices to be connected using the same 4 Flora pins.
- (3V, SDA, SCL and GND pins)

Onboard Neo_Pixel

FLORA Accelerometer/Compass Sensor - LSM303



Contains two sensors

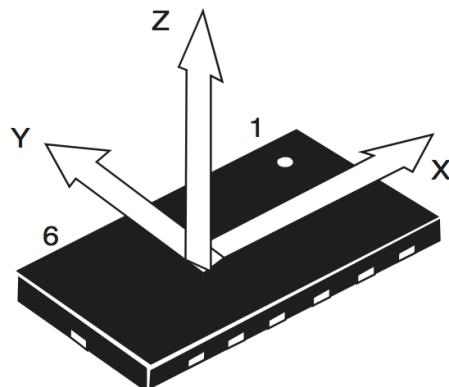
3-axis Accelerometer

- Tell you which direction is down towards the Earth (by measuring gravity)
- and how fast the board is accelerating in 3D space

Magnetometer (Compass sensor)

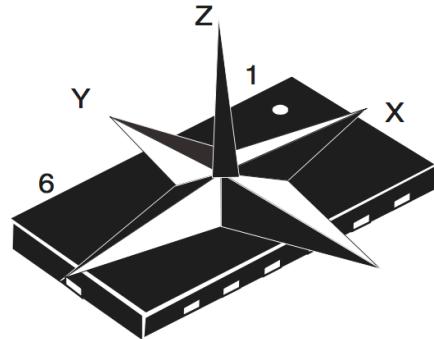
- Senses where the strongest magnetic force is coming from, generally used to detect magnetic north.

LSM303DLHC



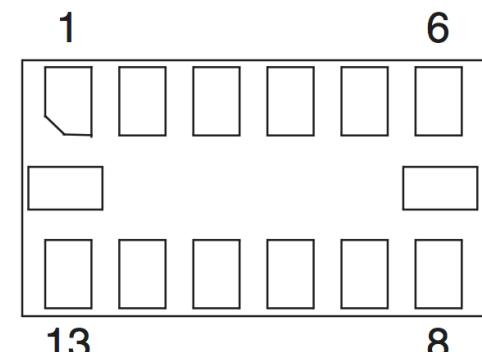
TOP VIEW

DIRECTION OF
DETECTABLE
ACCELERATIONS



TOP VIEW

DIRECTION OF
DETECTABLE
MAGNETIC FIELDS



BOTTOM VIEW

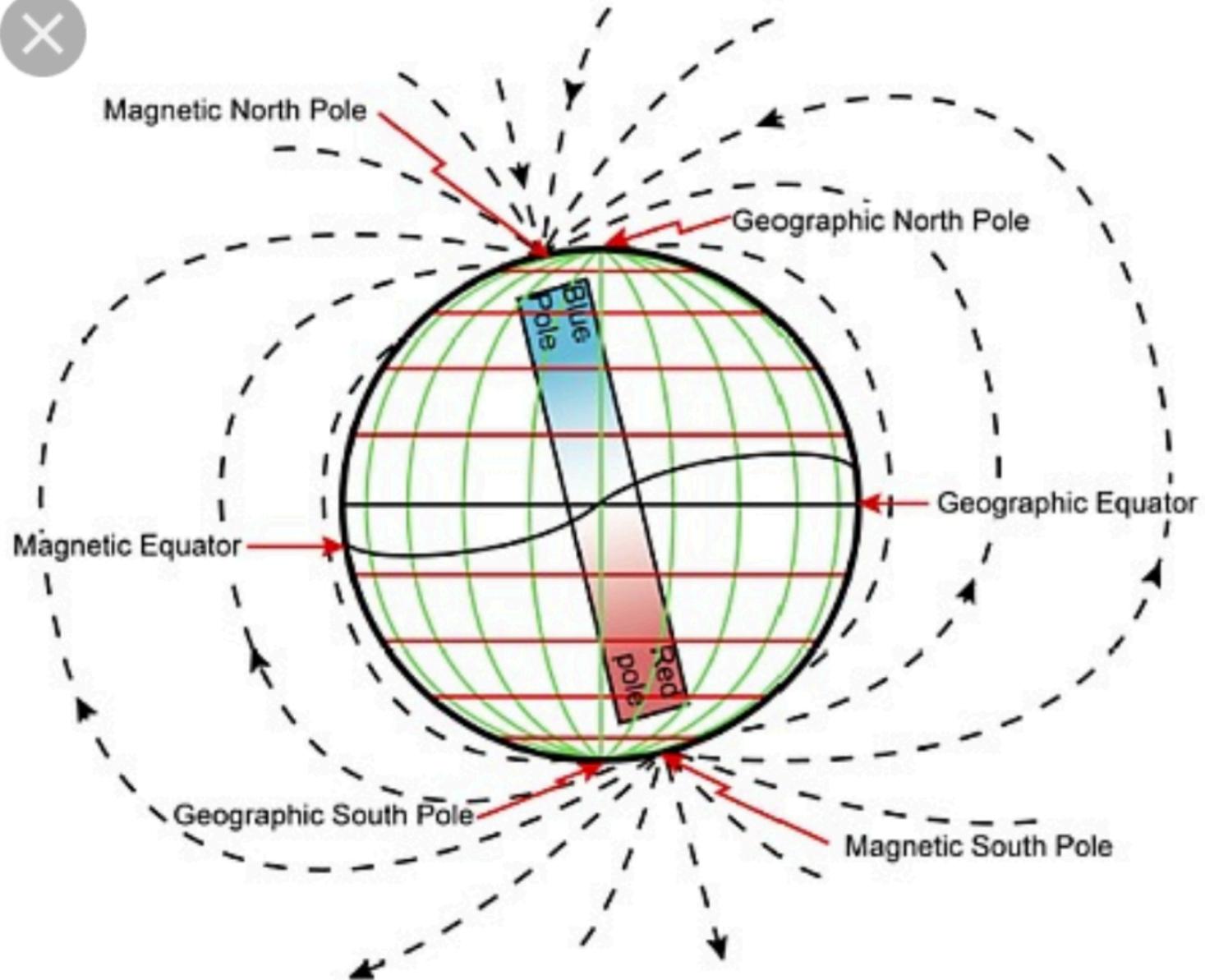
AM09237V1

3D accelerometer and 3D magnetometer module

Uses of Magnetometer

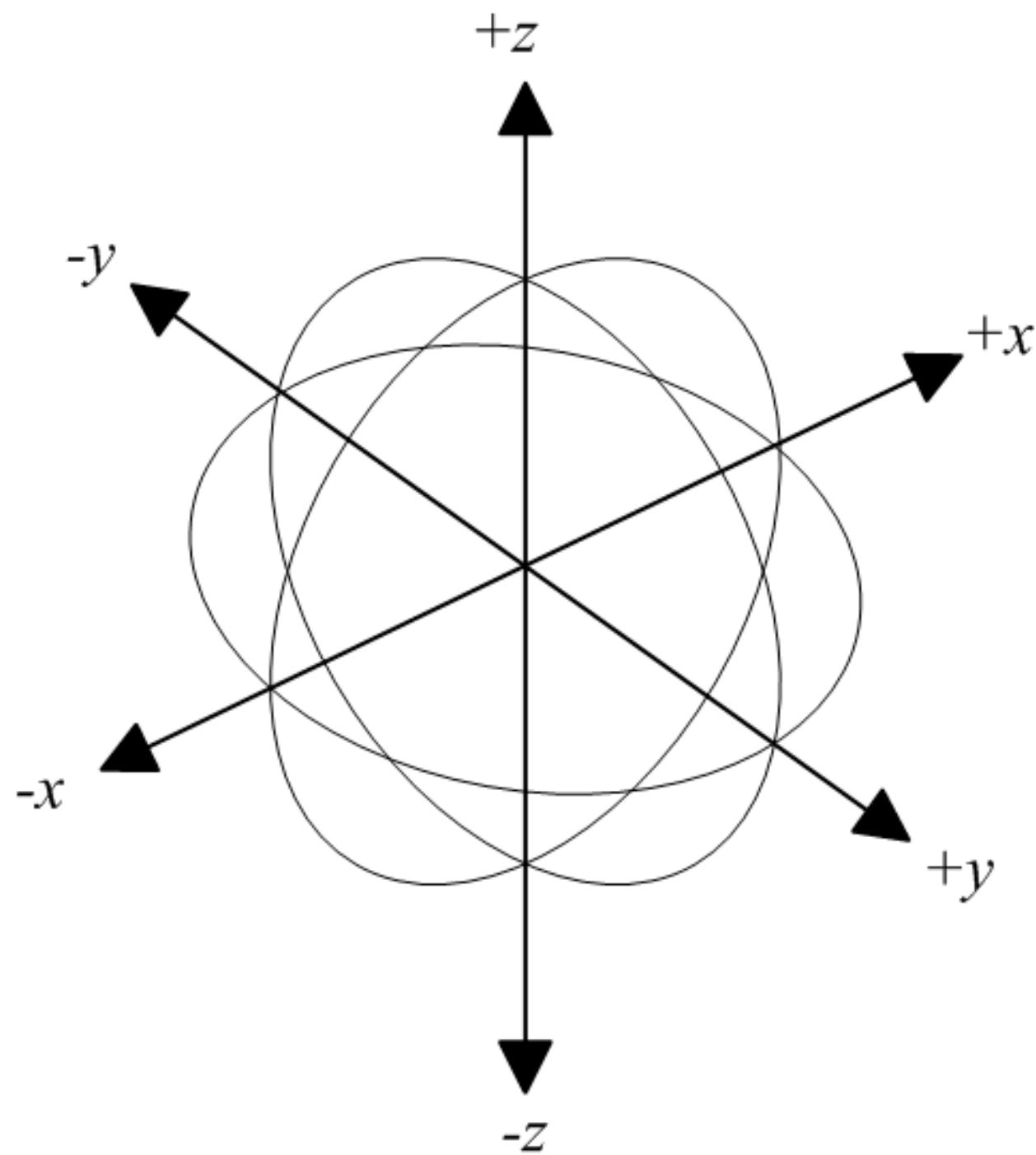
- Magnetometer gives the direction of strongest magnetic field.
- Needs to be parallel to the earth to give correct reading.
- Used in navigation to locate North.
- Gives magnetic North. However

X

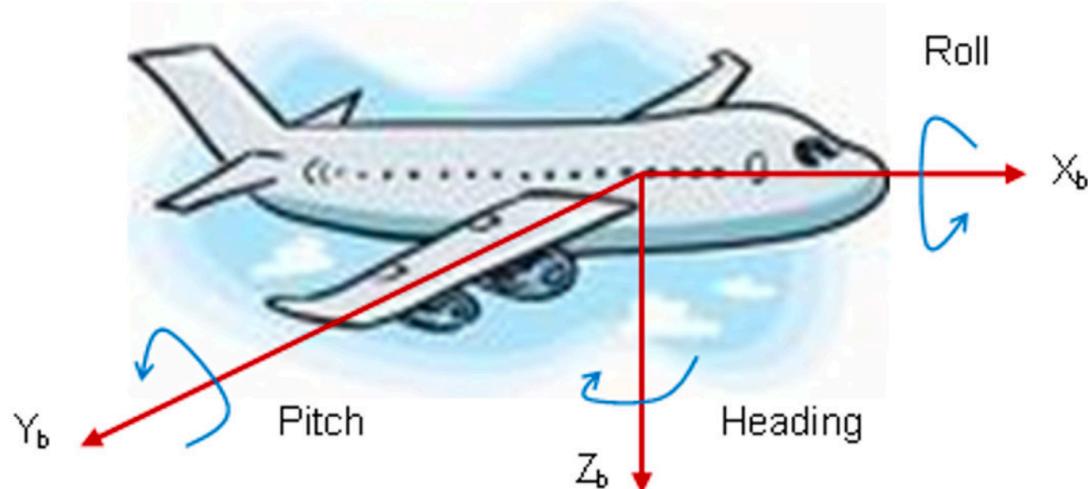


Uses of accelerometer

- Accelerometers are devices that measure how fast a object is accelerating in 3D space
- Acceleration is the rate of change of the velocity (speed with direction) of an object.



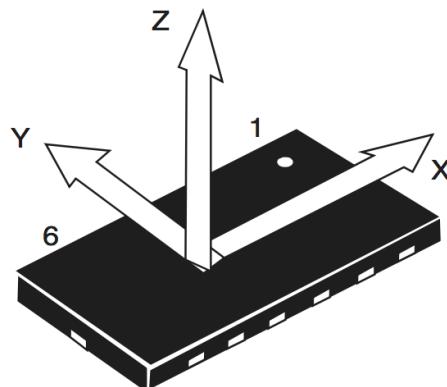
3 axis of acceleromiter



AM06765v1

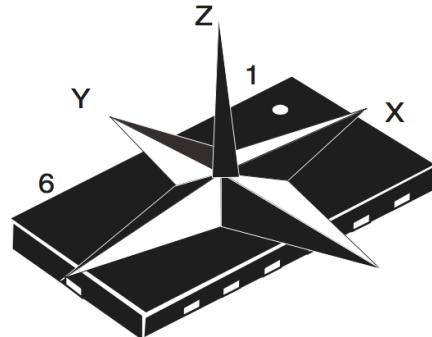
The device (or aircraft) body coordinates $X_b/Y_b/Z_b$ are defined as forward/right/down based on the right-hand rule.

LSM303DLHC



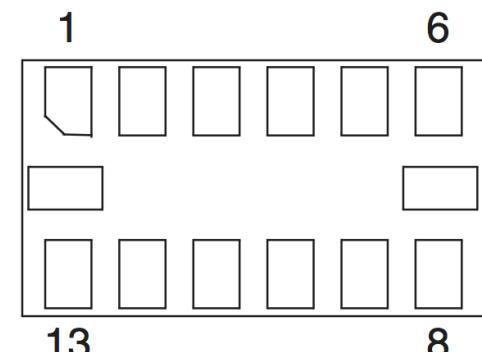
TOP VIEW

DIRECTION OF
DETECTABLE
ACCELERATIONS



TOP VIEW

DIRECTION OF
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MAGNETIC FIELDS



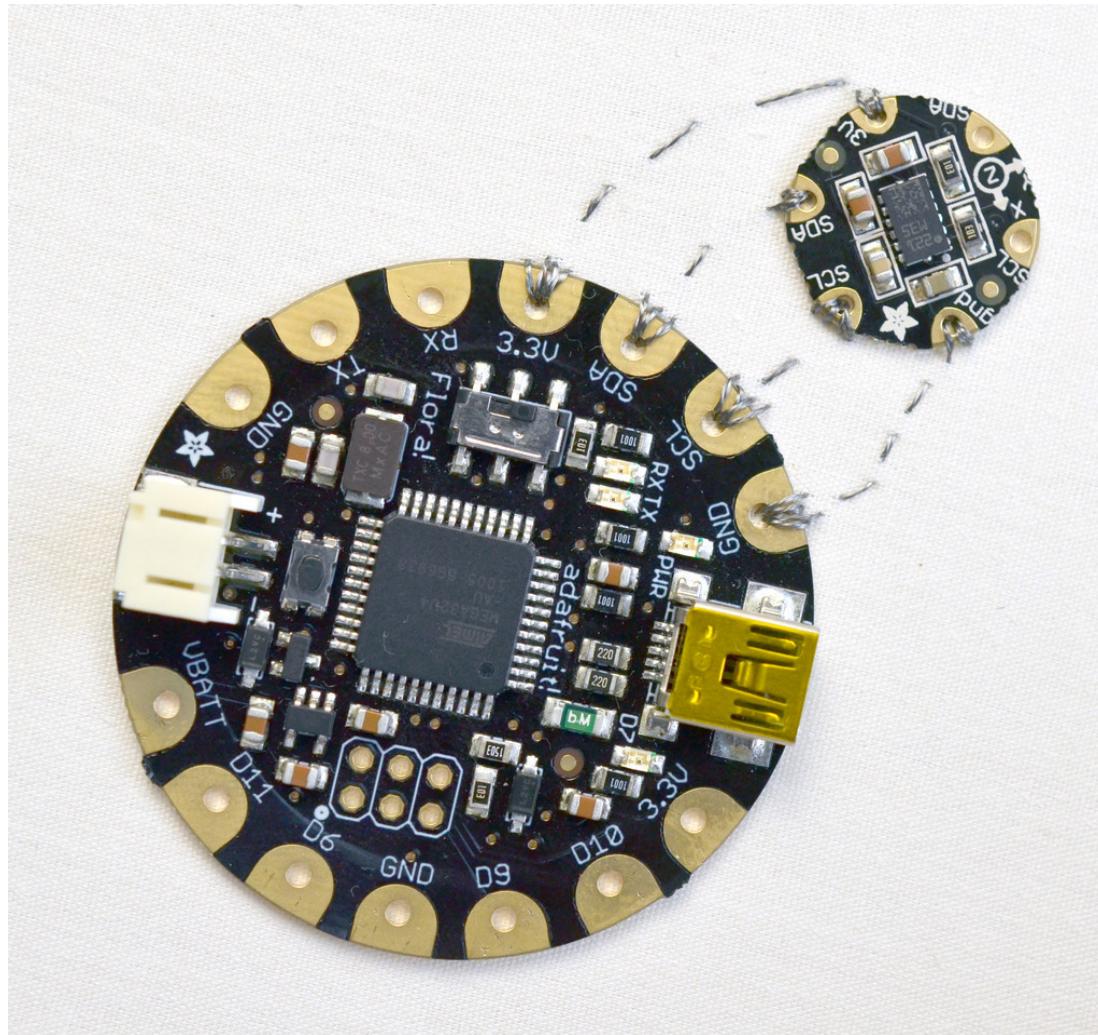
BOTTOM VIEW

AM09237V1

3D accelerometer and 3D magnetometer module

Acceleration due to gravity

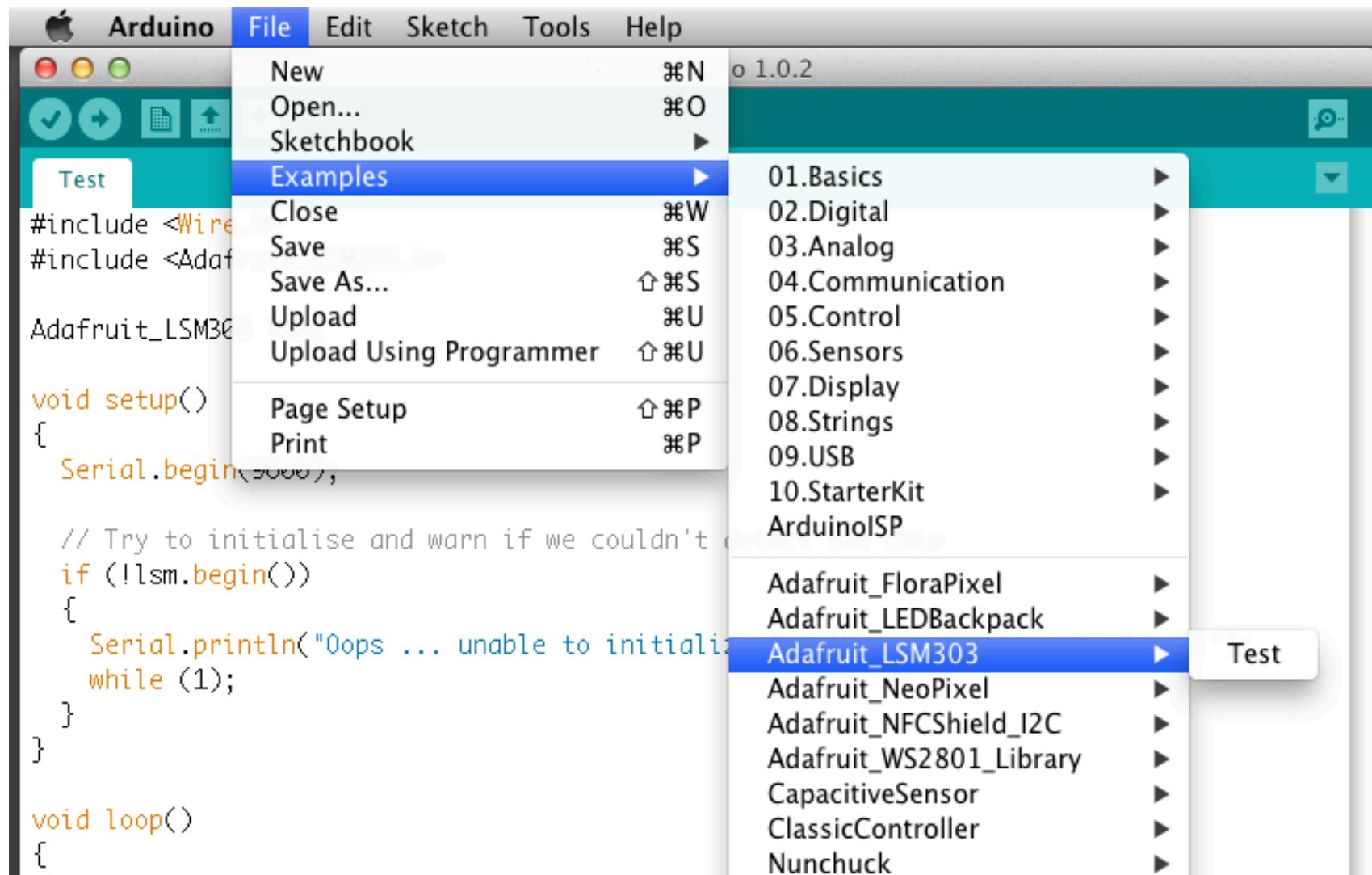
- Accelerometers are often used to calculate a tilt angle by using acceleration due to gravity.
- They can only do this reliably when they are static.



Flora	->	Accelerometer
3.3v	->	3v
SDA	->	SDA
SCL	->	SCL
GND	->	GND

Library

- Download the [Adafruit LSM303](#) library from Github by clicking the ZIP button. Unzip the downloaded file and rename the resulting folder "Adafruit_LSM303," then move it to your Arduino libraries folder.



File-->Examples-->Adafruit_LSM303-->Test

The image shows the Arduino IDE interface on a Mac OS X system. On the left, the code editor window titled "Test | Arduino 1.0.2" contains the following sketch:

```
#include <Wire.h>
#include <Adafruit_LSM303.h>

Adafruit_LSM303 lsm;

void setup()
{
    Serial.begin(9600);

    // Try to initialise and warn if we couldn't detect the chip
    if (!lsm.begin())
    {
        Serial.println("Oops ... unable to initialize the LSM303");
        while (1);
    }
}
```

On the right, the serial monitor window titled "Untitled 8" is open, connected to the port "/dev/tty.usbmodemfd13131". It displays the following output:

```
Accel X: -20 Y: 16 Z: 1084
Mag X: -528 Y: -38 Z: -146
Accel X: -12 Y: 16 Z: 1096
Mag X: -532 Y: -40 Z: -139
Accel X: -20 Y: 20 Z: 1080
Mag X: -529 Y: -43 Z: -140
Accel X: -16 Y: 8 Z: 1096
Mag X: -529 Y: -43 Z: -141
```

Open the serial monitor and watch the accelerometer values pour in!

LSM303DLHC

- The LSM303DLHC has linear acceleration full scales of $\pm 2g$ / $\pm 4g$ / $\pm 8g$ / $\pm 16g$
- and a magnetic field full scale of ± 1.3 / ± 1.9 / ± 2.5 / ± 4.0 / ± 4.7 / ± 5.6 / ± 8.1 gauss.

g or G

- An acceleration equal to the acceleration of gravity, 980.665 centimeter-second-squared, approximately 32.2 feet per second per second at sea level

gauss

- The **gauss**, abbreviated as G or Gs, is the cgs (centimetre–gram–second)unit of measurement of magnetic flux density (or "magnetic induction")

Typical Use of Accelerometer/Magnetometer Chip

- Electronic compass system
- Combine with GPS for Satnav
- Track fitness – FitBit
- Drone/robot orientation
- Mobile phone - Determining screen orientation or actions such as shaking the smartphone
- Object orientation – Wii controller/ VR input

Accelerometer

- Accelerometer can tell you which direction is down towards the Earth (by measuring gravity)
- Allowing you to calculate the angle of inclination of an object.

Problems!

- Unreliable at measuring orientation whilst accelerating.
- Solution – combine with a gyroscope

Resources

- LSM303dlhc datasheet (<https://cdn-shop.adafruit.com/datasheets/LSM303DLHC.PDF>)
- LSM303DLHC ACCELEROMETER AND MAGNETOMETER EXPLORATION – (<http://www.instructables.com/id/LSM303DLHC-exploration/>)
- Tilt measurement – (http://www.st.com/content/ccc/resource/technical/document/application_note/d2/d6/22/4f/b9/8f/45/59/DM00119046.pdf/files/DM00119046.pdf/jcr:content/translations/en.DM00119046.pdf)