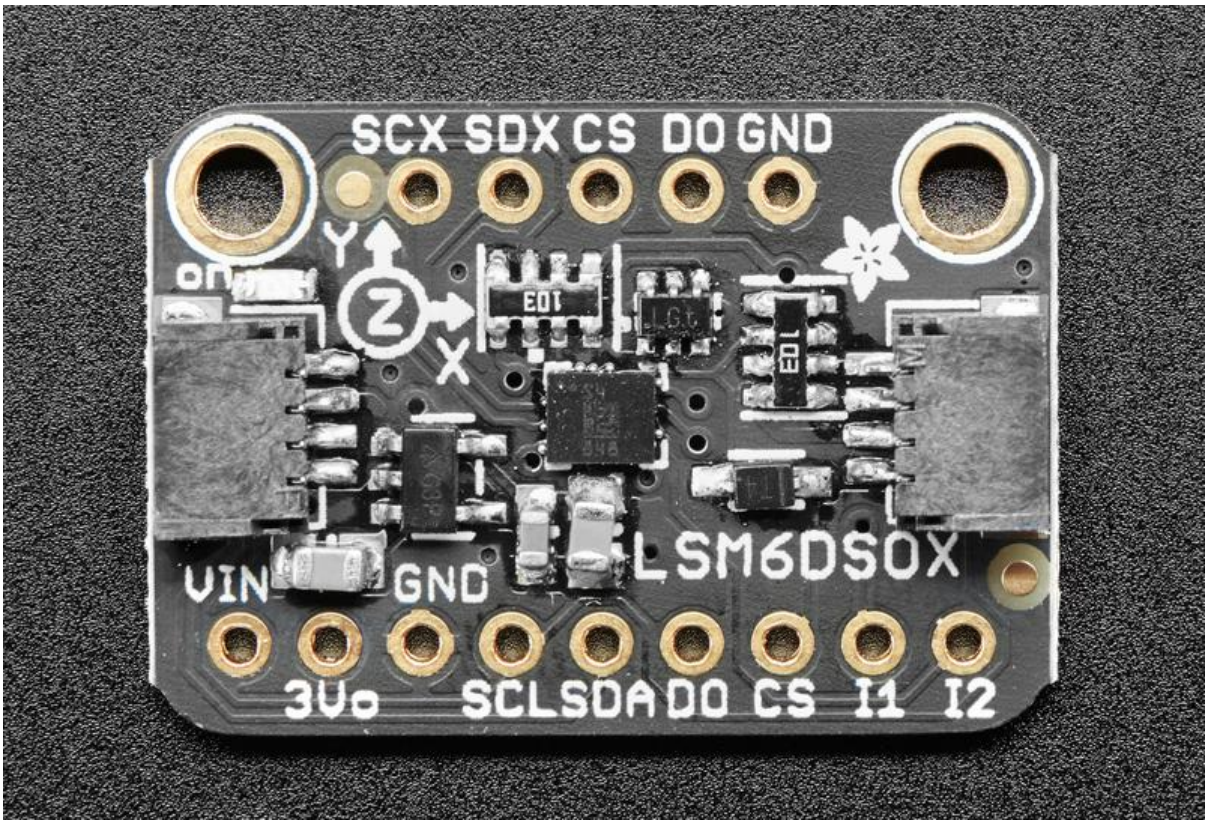
LSM6DSOX, ISM330DHC, & LSM6DSO32 6 DoF IMUs

Created by Bryan Siepert



https://learn.adafruit.com/lsm6dsox-and-ism330dhc-6-dof-imu

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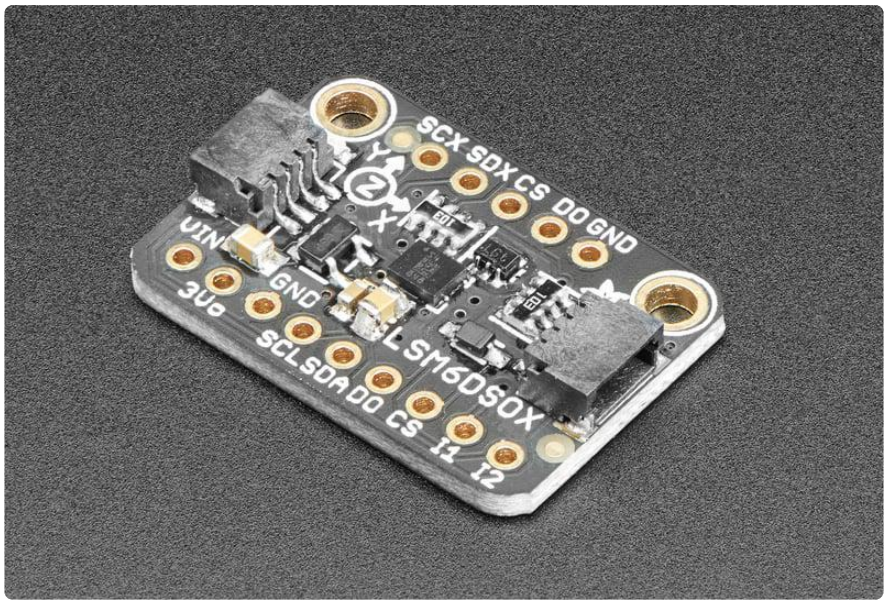
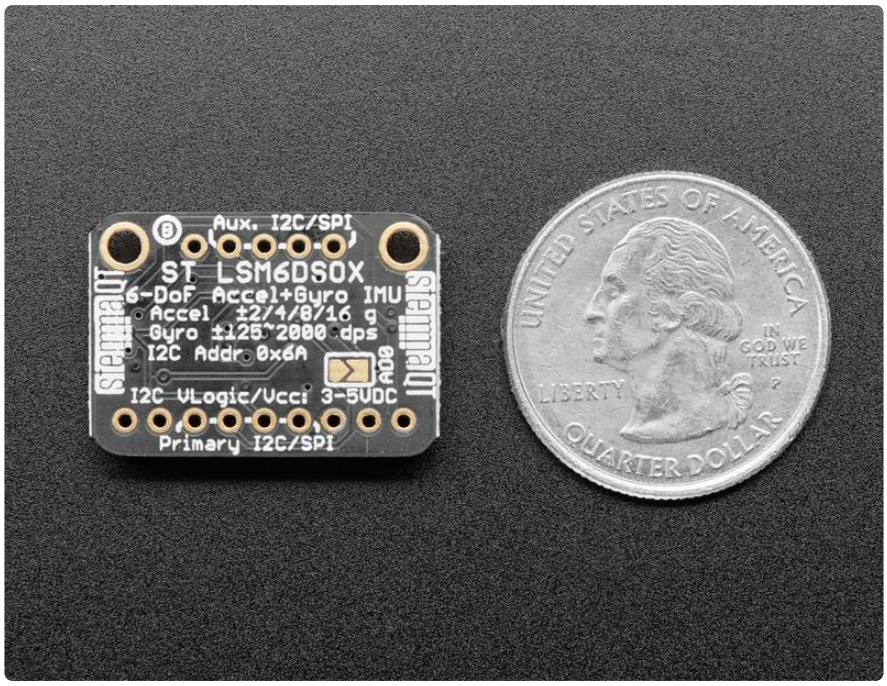
Overview



Behold, the ST LSM6DSOX: The latest in a long line of quality Accelerometer+Gyroscope 6-DOF IMUs from ST. Along with the LSM6DSOX, this guide will cover the industrial version, the ISM330DHCX and their wider range sibling the LSM6DSO32. All are pin-compatible and are nearly code-compatible - we'll be using the same library code and wiring diagrams to connect to both

In the ISM330DHCX the sensing elements of the accelerometer and of the gyroscope are implemented on the same silicon die, thus guaranteeing superior stability and robustness. It also has an extended temperature range of -40 to +105 °C compared to the LSM6DSOX's -40 to +85 °C. Finally, the ISM330's gyroscope can measure up to ±4000 dps, the LSM6DSOX tops out at ±2000 dps. If those extras aren't essential for your needs, the LSM6DSOX will do quite nicely.

Should you wish for a wider range of acceleration measurement, the LSM6DSO32 will have you covered. Compared to the +/-2 to +/- 16g , the LSM6DSO32 can measure higher acceleration amounts and is configurable from +/- 4-32g! This will allow for capturing more extreme motion events.



All three sensors are great IMU sensors with 6 degrees of freedom - 3 degrees each of linear acceleration and angular velocity at varying rates within a respectable range.

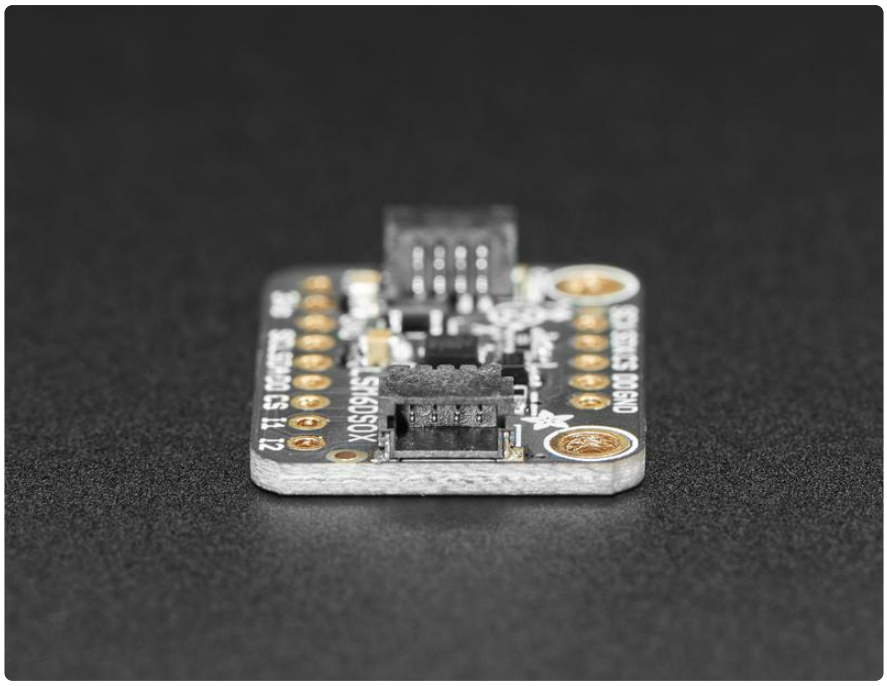
For the LSM6DSOX and ISM330DHCX, the accelerometers have a respectable range of: ±2/±4/±8/±16 g at 1.6 Hz to 6.7KHz update rate. The LSM6DSO32's accelerometers can measure ±4/±8/±16±32 at the cost of a bit of additional noise in the signal.

For the gyroscopes: ±125/±250/±500/±1000/±2000 dps (plus ±4000 dps for the ISM330) at 12.5 Hz to 6.7 KHz. There's also some nice extras, such as built in tap detection, activity detection, pedometer/step counter and in the LSM6DSOX and ISM330DHCX a programmable finite state machine / machine learning core that can perform some basic gesture recognition.

For interfacing, you can use either SPI or I2C - there's two configurable interrupt pins. For advanced usage, you can attach additional devices to an external I2C/SPI port - used for optical image stabilization.

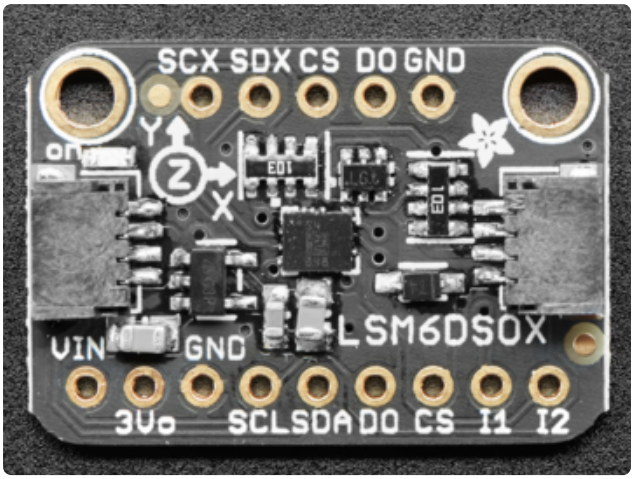
To make getting started fast and easy, we placed the sensors on compact breakout boards with voltage regulation and level-shifted inputs. That way you can use them with 3V or 5V power/logic devices without worry.

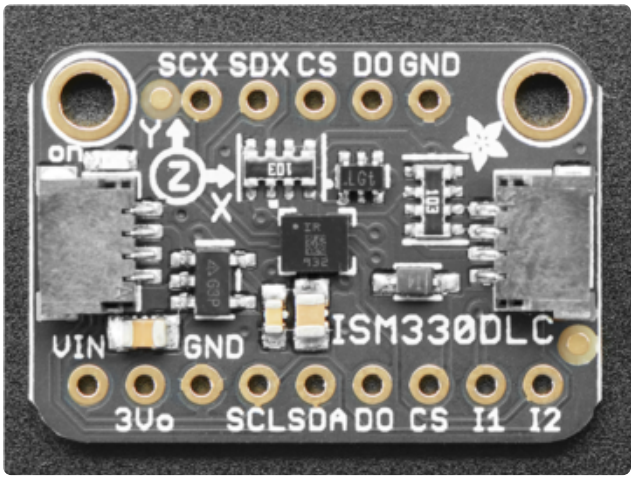
We also wrote libraries to help you get these sensors integrated with your Arduino/C++ or CircuitPython/Python boards such as Raspberry Pi or other single board computers.

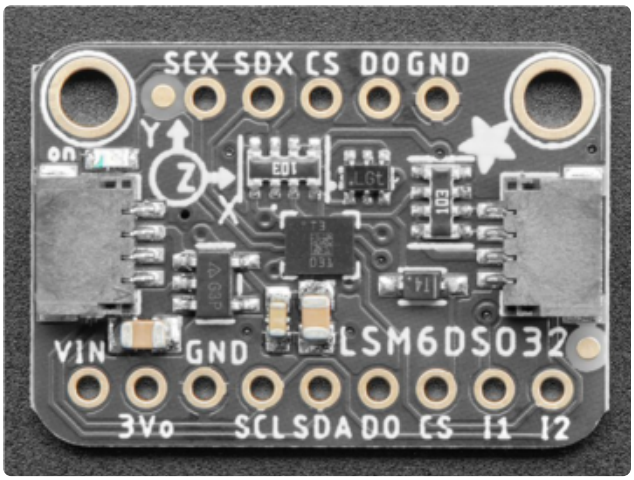


Additionally since it speaks I2C you can easily connect it up with two wires (plus power and ground!). We've even included SparkFun qwiic () compatible STEMMA QT ( ) connectors for the I2C bus so you don't even need to solder! Just wire up to your favorite micro with a plug-and-play cable to get 6 DoF data ASAP.

Pinouts







The top of each breakout is very similar! They include The names of all the pins which you can reference in the lists below

Power Pins

- Vin - this is the power pin. Since the sensor chip uses 3 VDC, we have included a voltage regulator on board that will take 3-5VDC and safely convert it down. To power the board, give it the same power as the logic level of your microcontroller - e.g. for a 5V microcontroller like Arduino, use 5V

- 3Vo - this is the 3.3V output from the voltage regulator, you can grab up to 100mA from this if you like
- GND - common ground for power and logic

I2C Logic Pins

- SCL - I2C clock pin, connect to your microcontroller's I2C clock line. This pin is level shifted so you can use 3-5V logic, and there's a 10K pullup on this pin.
- SDA -I2C data pin, connect to your microcontroller's I2C data line. This pin is level shifted so you can use 3-5V logic, and there's a 10K pullup on this pin.
- STEMMA QT () - These connectors allow you to connectors to dev boards with S TEMMA QT connectors or to other things with various associated accessories ()

SPI Logic pins:

All pins going into the breakout have level shifting circuitry to make them 3-5V logic level safe. Use whatever logic level is on Vin!

- SCK - This is also the SPI Clock pin, it's an input to the chip
- DO (Bottom) - this is the serial Data Out / Microcontroller In Sensor Out pin, for data sent from the LSM6DSOX, ISM330DHCX, or LSM6DSO32 to your processor.
- SDA - this is also the Serial Data In / Microcontroller Out Sensor In pin, for data sent from your processor to the LSM6DSOX, ISM330DHCX, or LSM6DSO32
- CS (Bottom) - this is the Chip Select pin, drop it low to start an SPI transaction. Its an input to the chip

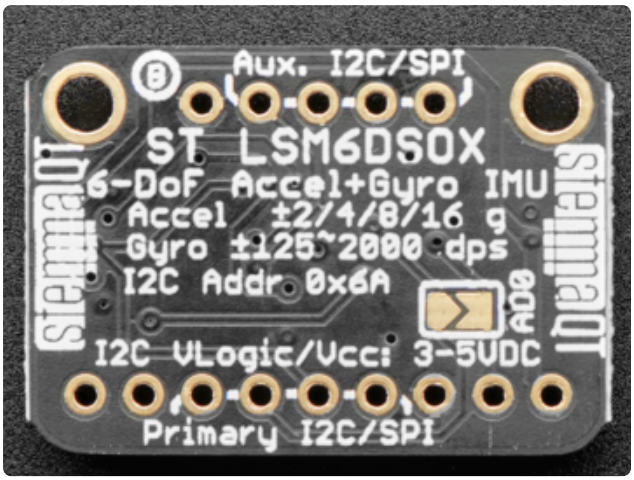
If you want to connect multiple LSM6DSOX, ISM330DHCX, or LSM6DSO32's to one microcontroller, have them share the SDI, DO and SCK pins. Then assign each one a unique CS pin.

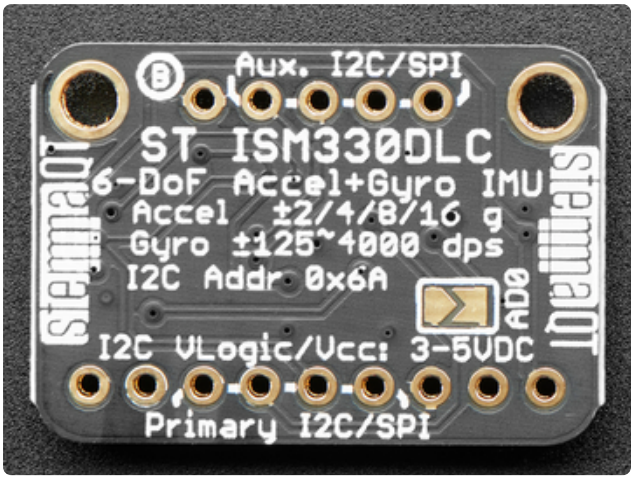
Other Pins

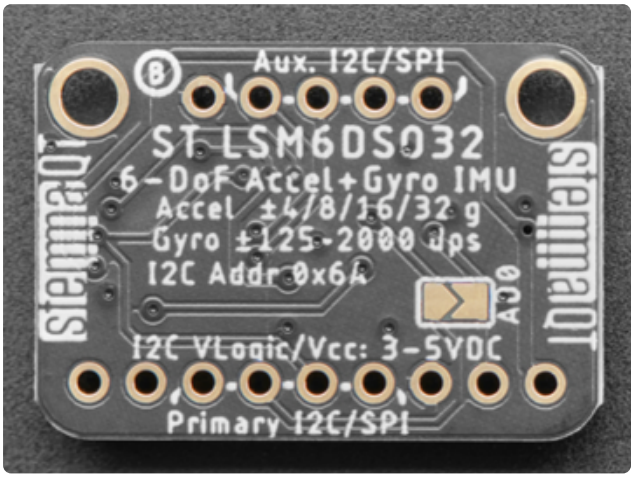
- INT1 -This is the primary interrupt pin. You can setup the LSM6DSOX, ISM330DHCX, or LSM6DSO32 to pull this low when certain conditions are met such as new measurement data being available. Consult the datasheet () for usage
- INT2 -This is the primary interrupt pin. You can setup the LSM6DSOX, ISM330DHCX, or LSM6DSO32 to pull this low when certain conditions are met

such as new measurement data being available. Consult the datasheet () for usage

- D0 (Bottom) - I2C Address pin. Pulling this pin high or bridging the solder jumper on the back will change the I2C address from 0x6A to 0x6B
- SCX, SDX, Aux CS, DO (Top) - Pins for advanced users to connect the LSM6DSOX, ISM330DHCX, or LSM6DSO32 to another sensor. Consult the datasheet () for usage







The backs of the breakouts show additional information about the specifications of the sensor, as well as the I2C address and additional pin information

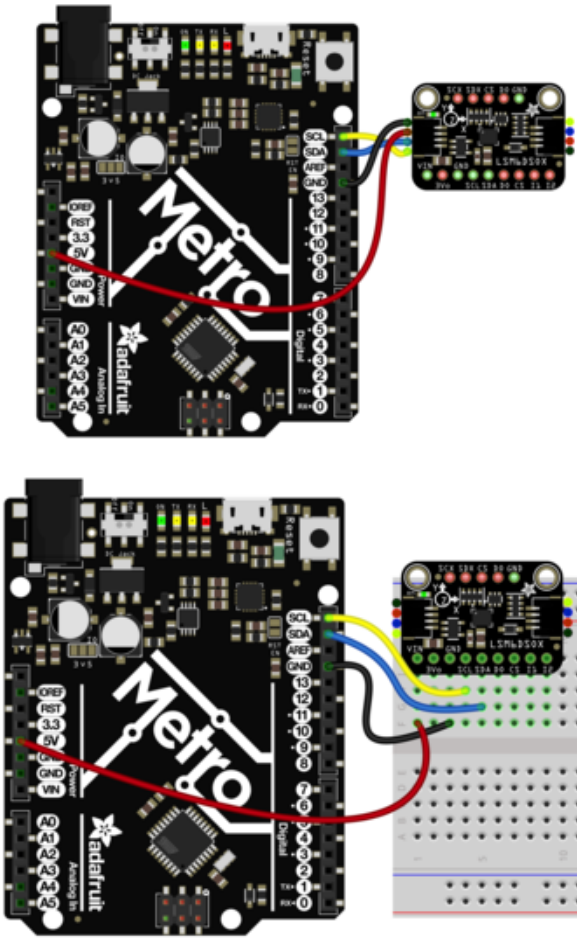
Arduino

Because they share the same pinout and I2C address, the examples below can be used for the LSM6DSOX, ISM330DHX, and LSM6DSO32

I2C Wiring

Use this wiring if you want to connect via I2C interface

By default, theI2C address is 0x6A. If you add a jumper from DO to 3.3V the address will change to 0x6B

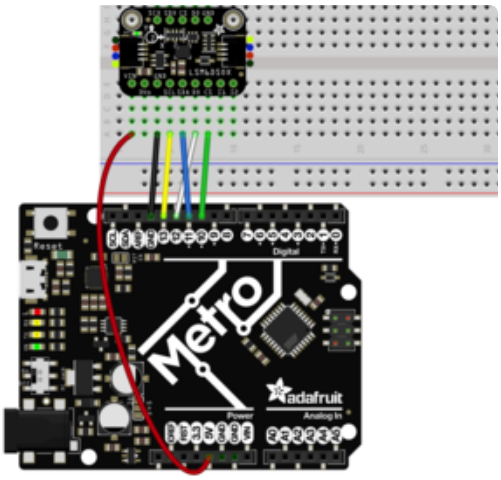


Connect board VIN (red wire) to Arduino 5V if you are running a 5V board Arduino (Uno, etc.). If your board is 3V, connect to that instead.
Connect board GND (black wire) to Arduino GND
Connect board SCL (yellow wire) to Arduino SCL
Connect board SDA (blue wire) to Arduino SDA

The final results should resemble the illustration above, showing an Adafruit Metro development board.

SPI Wiring

Since this is a SPI-capable sensor, we can use hardware or 'software' SPI. To make wiring identical on all microcontrollers, we'll begin with 'software' SPI. The following pins should be used:

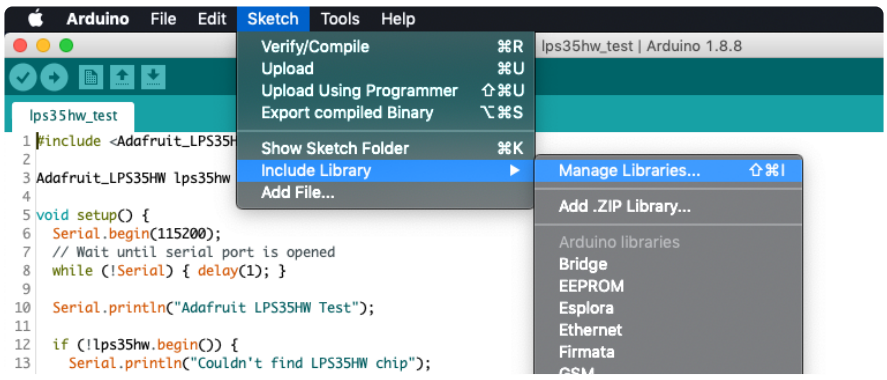


Connect Vin to the power supply, 3V or 5V is fine. Use the same voltage that the microcontroller logic is based off of
Connect GND to common power/data ground
Connect the SCL pin to Digital #13 but any pin can be used later
Connect the DO pin to Digital #12 but any pin can be used later
Connect the SDA pin to Digital #11 but any pin can be used later
Connect the CS pin Digital #10 but any pin can be used later

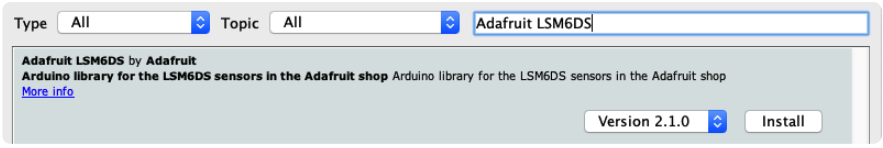
Later on, once we get it working, we can adjust the library to use hardware SPI if you desire, or change the pins to others.

Library Installation

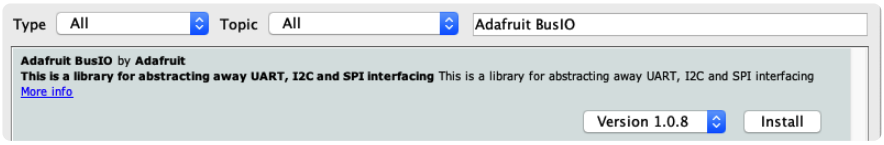
You can install the Adafruit LSM6DS Library for Arduino using the Library Manager in the Arduino IDE. This will work for the LSM6DSOX, ISM330DHCX, LSM6DSO32, and even the LSM6DS33:



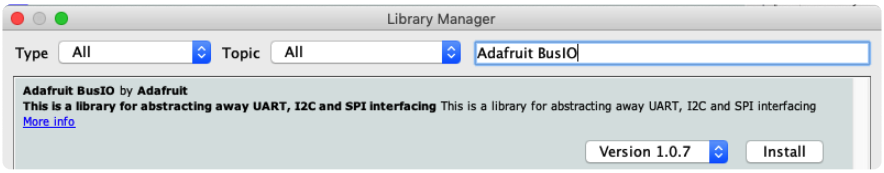
Click the Manage Libraries ... menu item, search for Adafruit LSM6DS, and select the Adafruit LSM6DS library:



Then follow the same process for the Adafruit BusIO library.



Finally follow the same process for the Adafruit Unified Sensor library:



Load Example - LSM6DSOX, ISM330DHCX, or LSM6DSO32

The library includes different examples for each of the sensors it supports, so you will need to select the correct one.

If you are using an LSM6DSOX, open up File -> Examples -> Adafruit LSM6DS -> adafruit_lsm6dsox_test and upload to your Arduino wired up to the sensor.

If you are using an ISM330DHCX, open up File -> Examples -> Adafruit LSM6DS -> adafruit_ism330dhcx_test and upload to your Arduino wired up to the sensor.

If you are using an LSM6DSO32, open up File -> Examples -> Adafruit LSM6DS -> adafruit_lsm6dso32_test and upload to your Arduino wired up to the sensor.

Depending on whether you are using I2C or SPI, change the pin names and comment or uncomment the following lines.

Note that the code snippet and screenshot below are from the LSM6DSOX example. The ISM330DHCX and LSM6DSO32 examples will be similar but not identical

```
if (!lsm6dsox.begin_I2C()) {
  //if (!lsm6dsox.begin_SPI(LPS_CS)) {
  //if (!lsm6dsox.begin_SPI(LPS_CS, LPS_SCK, LPS_MISO, LPS_MOSI)) {
```

Once you upload the code, you will see the accelerometer, gyro, and temperature measurements being printed when you open the Serial Monitor (Tools->Serial Monitor) at 115200 baud, similar to this:

```
Adafruit LSM6DSOX test!
LSM6DSOX Found!
Accelerometer range set to: +-2G
Gyro range set to: 250 degrees/s
Accelerometer data rate set to: 104 Hz
Gyro data rate set to: 104 Hz
                Temperature 23.87 deg C
                Accel X: 0.57   Y: -0.38       Z: 39.52 m/s^2
                Gyro X: 3.16    Y: -5.15        Z: -27.93 degrees/s

                Temperature 23.07 deg C
                Accel X: 0.15   Y: -0.10       Z: 9.89 m/s^2
                Gyro X: 1.23    Y: 0.11         Z: -0.51 degrees/s
```

Give the sensor a wiggle or a spin and watch how the measurements change!

Example Code - LSM6DSOX

```
// Basic demo for accelerometer & gyro readings from Adafruit
// LSM6DSOX sensor

#include <Adafruit_LSM6DSOX.h>

// For SPI mode, we need a CS pin
#define LSM_CS 10
// For software-SPI mode we need SCK/MOSI/MISO pins
#define LSM_SCK 13
#define LSM_MISO 12
#define LSM_MOSI 11

Adafruit_LSM6DSOX sox;
void setup(void) {
  Serial.begin(115200);
  while (!Serial)
    delay(10); // will pause Zero, Leonardo, etc until serial console opens

  Serial.println("Adafruit LSM6DSOX test!");

  if (!sox.begin_I2C()) {
    // if (!sox.begin_SPI(LSM_CS)) {
    // if (!sox.begin_SPI(LSM_CS, LSM_SCK, LSM_MISO, LSM_MOSI)) {
    // Serial.println("Failed to find LSM6DSOX chip");
    while (1) {
      delay(10);
    }
  }

  Serial.println("LSM6DSOX Found!");

  // sox.setAccelRange(LSM6DS_ACCEL_RANGE_2_G);
  Serial.print("Accelerometer range set to: ");
  switch (sox.getAccelRange()) {
  case LSM6DS_ACCEL_RANGE_2_G:
```

```
  Serial.println("+-2G");
  break;
case LSM6DS_ACCEL_RANGE_4_G:
  Serial.println("+-4G");
  break;
case LSM6DS_ACCEL_RANGE_8_G:
  Serial.println("+-8G");
  break;
case LSM6DS_ACCEL_RANGE_16_G:
  Serial.println("+-16G");
  break;
}

// sox.setGyroRange(LSM6DS_GYRO_RANGE_250_DPS );
Serial.print("Gyro range set to: ");
switch (sox.getGyroRange()) {
case LSM6DS_GYRO_RANGE_125_DPS:
  Serial.println("125 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_250_DPS:
  Serial.println("250 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_500_DPS:
  Serial.println("500 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_1000_DPS:
  Serial.println("1000 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_2000_DPS:
  Serial.println("2000 degrees/s");
  break;
case ISM330DHCX_GYRO_RANGE_4000_DPS:
  break; // unsupported range for the DSOX
}

// sox.setAccelDataRate(LSM6DS_RATE_12_5_HZ);
Serial.print("Accelerometer data rate set to: ");
switch (sox.getAccelDataRate()) {
case LSM6DS_RATE_SHUTDOWN:
  Serial.println("0 Hz");
  break;
case LSM6DS_RATE_12_5_HZ:
  Serial.println("12.5 Hz");
  break;
case LSM6DS_RATE_26_HZ:
  Serial.println("26 Hz");
  break;
case LSM6DS_RATE_52_HZ:
  Serial.println("52 Hz");
  break;
case LSM6DS_RATE_104_HZ:
  Serial.println("104 Hz");
  break;
case LSM6DS_RATE_208_HZ:
  Serial.println("208 Hz");
  break;
case LSM6DS_RATE_416_HZ:
  Serial.println("416 Hz");
  break;
case LSM6DS_RATE_833_HZ:
  Serial.println("833 Hz");
  break;
case LSM6DS_RATE_1_66K_HZ:
  Serial.println("1.66 KHz");
  break;
case LSM6DS_RATE_3_33K_HZ:
  Serial.println("3.33 KHz");
  break;
case LSM6DS_RATE_6_66K_HZ:
```

```
    Serial.println("6.66 KHz");
    break;
  }

  // sox.setGyroDataRate(LSM6DS_RATE_12_5_HZ);
  Serial.print("Gyro data rate set to: ");
  switch (sox.getGyroDataRate()) {
  case LSM6DS_RATE_SHUTDOWN:
    Serial.println("0 Hz");
    break;
  case LSM6DS_RATE_12_5_HZ:
    Serial.println("12.5 Hz");
    break;
  case LSM6DS_RATE_26_HZ:
    Serial.println("26 Hz");
    break;
  case LSM6DS_RATE_52_HZ:
    Serial.println("52 Hz");
    break;
  case LSM6DS_RATE_104_HZ:
    Serial.println("104 Hz");
    break;
  case LSM6DS_RATE_208_HZ:
    Serial.println("208 Hz");
    break;
  case LSM6DS_RATE_416_HZ:
    Serial.println("416 Hz");
    break;
  case LSM6DS_RATE_833_HZ:
    Serial.println("833 Hz");
    break;
  case LSM6DS_RATE_1_66K_HZ:
    Serial.println("1.66 KHz");
    break;
  case LSM6DS_RATE_3_33K_HZ:
    Serial.println("3.33 KHz");
    break;
  case LSM6DS_RATE_6_66K_HZ:
    Serial.println("6.66 KHz");
    break;
  }
}

void loop() {

  //  /* Get a new normalized sensor event */
  sensors_event_t accel;
  sensors_event_t gyro;
  sensors_event_t temp;
  sox.getEvent(&accel, &gyro, &temp);

  Serial.print("\t\tTemperature ");
  Serial.print(temp.temperature);
  Serial.println(" deg C");

  /* Display the results (acceleration is measured in m/s^2) */
  Serial.print("\t\tAccel X: ");
  Serial.print(accel.acceleration.x);
  Serial.print(" \tY: ");
  Serial.print(accel.acceleration.y);
  Serial.print(" \tZ: ");
  Serial.print(accel.acceleration.z);
  Serial.println(" m/s^2 ");

  /* Display the results (rotation is measured in rad/s) */
  Serial.print("\t\tGyro X: ");
  Serial.print(gyro.gyro.x);
  Serial.print(" \tY: ");
  Serial.print(gyro.gyro.y);
```

```
  Serial.print(" \tZ: ");
  Serial.print(gyro.gyro.z);
  Serial.println(" radians/s ");
  Serial.println();

  delay(100);

  //  // serial plotter friendly format

  //  Serial.print(temp.temperature);
  //  Serial.print(",");

  //  Serial.print(accel.acceleration.x);
  //  Serial.print(","); Serial.print(accel.acceleration.y);
  //  Serial.print(","); Serial.print(accel.acceleration.z);
  //  Serial.print(",");

  // Serial.print(gyro.gyro.x);
  // Serial.print(","); Serial.print(gyro.gyro.y);
  // Serial.print(","); Serial.print(gyro.gyro.z);
  // Serial.println();
  //  delayMicroseconds(10000);
}
```

Example Code - ISM330DHCX

```
// Basic demo for accelerometer/gyro readings from Adafruit ISM330DHCX

#include <Adafruit_ISM330DHCX.h>

// For SPI mode, we need a CS pin
#define LSM_CS 10
// For software-SPI mode we need SCK/MOSI/MISO pins
#define LSM_SCK 13
#define LSM_MISO 12
#define LSM_MOSI 11

Adafruit_ISM330DHCX ism330dhcx;
void setup(void) {
  Serial.begin(115200);
  while (!Serial)
    delay(10); // will pause Zero, Leonardo, etc until serial console opens

  Serial.println("Adafruit ISM330DHCX test!");

  if (!ism330dhcx.begin_I2C()) {
    // if (!ism330dhcx.begin_SPI(LSM_CS)) {
    // if (!ism330dhcx.begin_SPI(LSM_CS, LSM_SCK, LSM_MISO, LSM_MOSI)) {
    Serial.println("Failed to find ISM330DHCX chip");
    while (1) {
      delay(10);
    }
  }

  Serial.println("ISM330DHCX Found!");

  // ism330dhcx.setAccelRange(LSM6DS_ACCEL_RANGE_2_G);
  Serial.print("Accelerometer range set to: ");
  switch (ism330dhcx.getAccelRange()) {
  case LSM6DS_ACCEL_RANGE_2_G:
    Serial.println("+-2G");
    break;
  case LSM6DS_ACCEL_RANGE_4_G:
    Serial.println("+-4G");
```

```
  break;
case LSM6DS_ACCEL_RANGE_8_G:
  Serial.println("+-8G");
  break;
case LSM6DS_ACCEL_RANGE_16_G:
  Serial.println("+-16G");
  break;
}

// ism330dhcx.setGyroRange(LSM6DS_GYRO_RANGE_250_DPS);
Serial.print("Gyro range set to: ");
switch (ism330dhcx.getGyroRange()) {
case LSM6DS_GYRO_RANGE_125_DPS:
  Serial.println("125 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_250_DPS:
  Serial.println("250 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_500_DPS:
  Serial.println("500 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_1000_DPS:
  Serial.println("1000 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_2000_DPS:
  Serial.println("2000 degrees/s");
  break;
case ISM330DHCX_GYRO_RANGE_4000_DPS:
  Serial.println("4000 degrees/s");
  break;
}

// ism330dhcx.setAccelDataRate(LSM6DS_RATE_12_5_HZ);
Serial.print("Accelerometer data rate set to: ");
switch (ism330dhcx.getAccelDataRate()) {
case LSM6DS_RATE_SHUTDOWN:
  Serial.println("0 Hz");
  break;
case LSM6DS_RATE_12_5_HZ:
  Serial.println("12.5 Hz");
  break;
case LSM6DS_RATE_26_HZ:
  Serial.println("26 Hz");
  break;
case LSM6DS_RATE_52_HZ:
  Serial.println("52 Hz");
  break;
case LSM6DS_RATE_104_HZ:
  Serial.println("104 Hz");
  break;
case LSM6DS_RATE_208_HZ:
  Serial.println("208 Hz");
  break;
case LSM6DS_RATE_416_HZ:
  Serial.println("416 Hz");
  break;
case LSM6DS_RATE_833_HZ:
  Serial.println("833 Hz");
  break;
case LSM6DS_RATE_1_66K_HZ:
  Serial.println("1.66 KHz");
  break;
case LSM6DS_RATE_3_33K_HZ:
  Serial.println("3.33 KHz");
  break;
case LSM6DS_RATE_6_66K_HZ:
  Serial.println("6.66 KHz");
  break;
}
```

```
  // ism330dhcx.setGyroDataRate(LSM6DS_RATE_12_5_HZ);
  Serial.print("Gyro data rate set to: ");
  switch (ism330dhcx.getGyroDataRate()) {
  case LSM6DS_RATE_SHUTDOWN:
    Serial.println("0 Hz");
    break;
  case LSM6DS_RATE_12_5_HZ:
    Serial.println("12.5 Hz");
    break;
  case LSM6DS_RATE_26_HZ:
    Serial.println("26 Hz");
    break;
  case LSM6DS_RATE_52_HZ:
    Serial.println("52 Hz");
    break;
  case LSM6DS_RATE_104_HZ:
    Serial.println("104 Hz");
    break;
  case LSM6DS_RATE_208_HZ:
    Serial.println("208 Hz");
    break;
  case LSM6DS_RATE_416_HZ:
    Serial.println("416 Hz");
    break;
  case LSM6DS_RATE_833_HZ:
    Serial.println("833 Hz");
    break;
  case LSM6DS_RATE_1_66K_HZ:
    Serial.println("1.66 KHz");
    break;
  case LSM6DS_RATE_3_33K_HZ:
    Serial.println("3.33 KHz");
    break;
  case LSM6DS_RATE_6_66K_HZ:
    Serial.println("6.66 KHz");
    break;
  }

  ism330dhcx.configInt1(false, false, true); // accelerometer DRDY on INT1
  ism330dhcx.configInt2(false, true, false); // gyro DRDY on INT2
}

void loop() {
  //  /* Get a new normalized sensor event */
  sensors_event_t accel;
  sensors_event_t gyro;
  sensors_event_t temp;
  ism330dhcx.getEvent(&accel, &gyro, &temp);

  Serial.print("\t\tTemperature ");
  Serial.print(temp.temperature);
  Serial.println(" deg C");

  /* Display the results (acceleration is measured in m/s^2) */
  Serial.print("\t\tAccel X: ");
  Serial.print(accel.acceleration.x);
  Serial.print(" \tY: ");
  Serial.print(accel.acceleration.y);
  Serial.print(" \tZ: ");
  Serial.print(accel.acceleration.z);
  Serial.println(" m/s^2 ");

  /* Display the results (rotation is measured in rad/s) */
  Serial.print("\t\tGyro X: ");
  Serial.print(gyro.gyro.x);
  Serial.print(" \tY: ");
  Serial.print(gyro.gyro.y);
  Serial.print(" \tZ: ");
```

```
  Serial.print(gyro.gyro.z);
  Serial.println(" radians/s ");
  Serial.println();

  delay(100);

  //  // serial plotter friendly format

  //  Serial.print(temp.temperature);
  //  Serial.print(",");

  //  Serial.print(accel.acceleration.x);
  //  Serial.print(","); Serial.print(accel.acceleration.y);
  //  Serial.print(","); Serial.print(accel.acceleration.z);
  //  Serial.print(",");

  // Serial.print(gyro.gyro.x);
  // Serial.print(","); Serial.print(gyro.gyro.y);
  // Serial.print(","); Serial.print(gyro.gyro.z);
  // Serial.println();
  //  delayMicroseconds(10000);
}
```

Example Code - LSM6DSO32

```
// Basic demo for accelerometer & gyro readings from Adafruit
// LSM6DSO32 sensor

#include <Adafruit_LSM6DSO32.h>

// For SPI mode, we need a CS pin
#define LSM_CS 10
// For software-SPI mode we need SCK/MOSI/MISO pins
#define LSM_SCK 13
#define LSM_MISO 12
#define LSM_MOSI 11

Adafruit_LSM6DSO32 dso32;
void setup(void) {
  Serial.begin(115200);
  while (!Serial)
    delay(10); // will pause Zero, Leonardo, etc until serial console opens

  Serial.println("Adafruit LSM6DSO32 test!");

  if (!dso32.begin_I2C()) {
    // if (!dso32.begin_SPI(LSM_CS)) {
    // if (!dso32.begin_SPI(LSM_CS, LSM_SCK, LSM_MISO, LSM_MOSI)) {
    // Serial.println("Failed to find LSM6DSO32 chip");
    while (1) {
      delay(10);
    }
  }

  Serial.println("LSM6DSO32 Found!");

  dso32.setAccelRange(LSM6DSO32_ACCEL_RANGE_8_G);
  Serial.print("Accelerometer range set to: ");
  switch (dso32.getAccelRange()) {
  case LSM6DSO32_ACCEL_RANGE_4_G:
    Serial.println("+-4G");
    break;
  case LSM6DSO32_ACCEL_RANGE_8_G:
    Serial.println("+-8G");
```

```
  break;
case LSM6DSO32_ACCEL_RANGE_16_G:
  Serial.println("+-16G");
  break;
case LSM6DSO32_ACCEL_RANGE_32_G:
  Serial.println("+-32G");
  break;
}

// dso32.setGyroRange(LSM6DS_GYRO_RANGE_250_DPS );
Serial.print("Gyro range set to: ");
switch (dso32.getGyroRange()) {
case LSM6DS_GYRO_RANGE_125_DPS:
  Serial.println("125 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_250_DPS:
  Serial.println("250 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_500_DPS:
  Serial.println("500 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_1000_DPS:
  Serial.println("1000 degrees/s");
  break;
case LSM6DS_GYRO_RANGE_2000_DPS:
  Serial.println("2000 degrees/s");
  break;
case ISM330DHCX_GYRO_RANGE_4000_DPS:
  break; // unsupported range for the DSO32
}

// dso32.setAccelDataRate(LSM6DS_RATE_12_5_HZ);
Serial.print("Accelerometer data rate set to: ");
switch (dso32.getAccelDataRate()) {
case LSM6DS_RATE_SHUTDOWN:
  Serial.println("0 Hz");
  break;
case LSM6DS_RATE_12_5_HZ:
  Serial.println("12.5 Hz");
  break;
case LSM6DS_RATE_26_HZ:
  Serial.println("26 Hz");
  break;
case LSM6DS_RATE_52_HZ:
  Serial.println("52 Hz");
  break;
case LSM6DS_RATE_104_HZ:
  Serial.println("104 Hz");
  break;
case LSM6DS_RATE_208_HZ:
  Serial.println("208 Hz");
  break;
case LSM6DS_RATE_416_HZ:
  Serial.println("416 Hz");
  break;
case LSM6DS_RATE_833_HZ:
  Serial.println("833 Hz");
  break;
case LSM6DS_RATE_1_66K_HZ:
  Serial.println("1.66 KHz");
  break;
case LSM6DS_RATE_3_33K_HZ:
  Serial.println("3.33 KHz");
  break;
case LSM6DS_RATE_6_66K_HZ:
  Serial.println("6.66 KHz");
  break;
}
```

```
  // dso32.setGyroDataRate(LSM6DS_RATE_12_5_HZ);
  Serial.print("Gyro data rate set to: ");
  switch (dso32.getGyroDataRate()) {
  case LSM6DS_RATE_SHUTDOWN:
    Serial.println("0 Hz");
    break;
  case LSM6DS_RATE_12_5_HZ:
    Serial.println("12.5 Hz");
    break;
  case LSM6DS_RATE_26_HZ:
    Serial.println("26 Hz");
    break;
  case LSM6DS_RATE_52_HZ:
    Serial.println("52 Hz");
    break;
  case LSM6DS_RATE_104_HZ:
    Serial.println("104 Hz");
    break;
  case LSM6DS_RATE_208_HZ:
    Serial.println("208 Hz");
    break;
  case LSM6DS_RATE_416_HZ:
    Serial.println("416 Hz");
    break;
  case LSM6DS_RATE_833_HZ:
    Serial.println("833 Hz");
    break;
  case LSM6DS_RATE_1_66K_HZ:
    Serial.println("1.66 KHz");
    break;
  case LSM6DS_RATE_3_33K_HZ:
    Serial.println("3.33 KHz");
    break;
  case LSM6DS_RATE_6_66K_HZ:
    Serial.println("6.66 KHz");
    break;
  }
}

void loop() {

  //  /* Get a new normalized sensor event */
  sensors_event_t accel;
  sensors_event_t gyro;
  sensors_event_t temp;
  dso32.getEvent(&accel, &gyro, &temp);

  Serial.print("\t\tTemperature ");
  Serial.print(temp.temperature);
  Serial.println(" deg C");

  /* Display the results (acceleration is measured in m/s^2) */
  Serial.print("\t\tAccel X: ");
  Serial.print(accel.acceleration.x);
  Serial.print(" \tY: ");
  Serial.print(accel.acceleration.y);
  Serial.print(" \tZ: ");
  Serial.print(accel.acceleration.z);
  Serial.println(" m/s^2 ");

  /* Display the results (rotation is measured in rad/s) */
  Serial.print("\t\tGyro X: ");
  Serial.print(gyro.gyro.x);
  Serial.print(" \tY: ");
  Serial.print(gyro.gyro.y);
  Serial.print(" \tZ: ");
  Serial.print(gyro.gyro.z);
  Serial.println(" radians/s ");
  Serial.println();
```

```
  delay(100);

  //  // serial plotter friendly format

  //  Serial.print(temp.temperature);
  //  Serial.print(",");

  //  Serial.print(accel.acceleration.x);
  //  Serial.print(","); Serial.print(accel.acceleration.y);
  //  Serial.print(","); Serial.print(accel.acceleration.z);
  //  Serial.print(",");

  // Serial.print(gyro.gyro.x);
  // Serial.print(","); Serial.print(gyro.gyro.y);
  // Serial.print(","); Serial.print(gyro.gyro.z);
  // Serial.println();
  //  delayMicroseconds(10000);
}
```

Arduino Docs

Arduino Docs ()

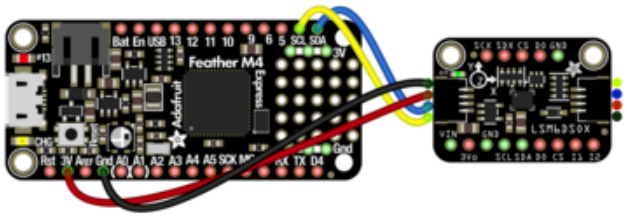
Python & CircuitPython

It's easy to use the LSM6DSOX or ISM330DHCX sensors with Python and CircuitPython, and the Adafruit CircuitPython LSM6DS () module. This module allows you to easily write Python code that reads measurements from the accelerometer and gyro, and will work with either sensor.

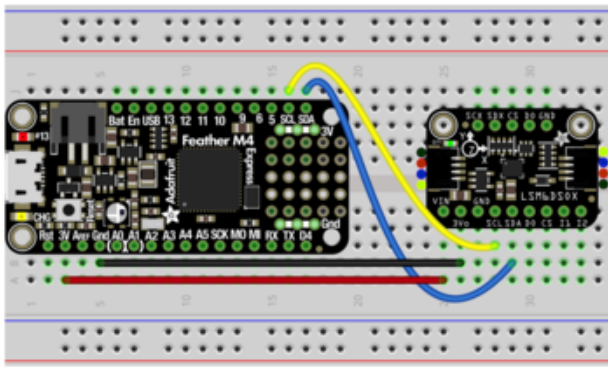
You can use this sensor with any CircuitPython microcontroller board or with a computer that has GPIO and Python thanks to Adafruit_Blinka, our CircuitPython-for-Python compatibility library ().

CircuitPython Microcontroller Wiring

First wire up a LSM6DSOX or ISM330DHCX to your board for an I2C connection, exactly as shown below. Here's an example of wiring a Feather M4 to the sensor with I2C:



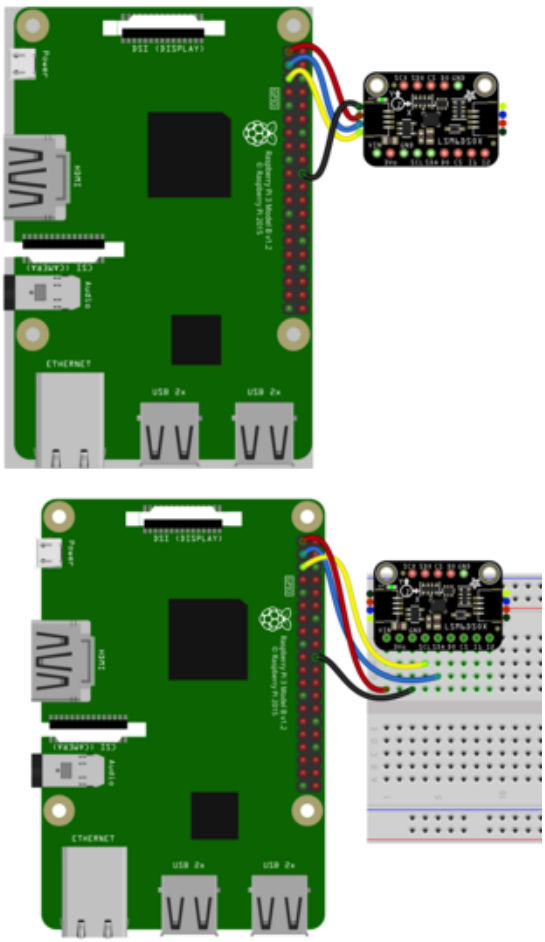
Board 3V to sensor VIN (red wire)
Board GND to sensor GND (black wire)
Board SCL to sensor SCL (yellow wire)
Board SDA to sensor SDA (blue wire)



Python Computer Wiring

Since there's dozens of Linux computers/boards you can use we will show wiring for Raspberry Pi. For other platforms, please visit the guide for CircuitPython on Linux to see whether your platform is supported ().

Here's the Raspberry Pi wired with I2C:



Pi 3V to sensor VCC (red wire)
Pi GND to sensor GND (black wire)
Pi SCL to sensor SCL (yellow wire)
Pi SDA to sensor SDA (blue wire)

CircuitPython Installation of LSM6DS Library

You'll need to install the Adafruit CircuitPython LSM6DS () library on your CircuitPython board. This library works with the LSM6DSOX, LSM6DS33, or ISM330DHCX

First make sure you are running the latest version of Adafruit CircuitPython () for your board.

Next you'll need to install the necessary libraries to use the hardware--carefully follow the steps to find and install these libraries from Adafruit's CircuitPython library bundle (). Our CircuitPython starter guide has a great page on how to install the library bundle ().

For non-express boards like the Trinket M0 or Gemma M0, you'll need to manually install the necessary libraries from the bundle:

- adafruit_lsm6ds.mpy
- adafruit_bus_device

- adafruit_register

Before continuing make sure your board's lib folder or root filesystem has the adafruit_lsm6ds.mpy, adafruit_bus_device, and adafruit_register files and folders copied over.

Next connect to the board's serial REPL ()so you are at the CircuitPython `>>>` prompt .

Python Installation of LSM6DS Library

You'll need to install the Adafruit_Blinka library that provides the CircuitPython support in Python. This may also require enabling I2C on your platform and verifying you are running Python 3. Since each platform is a little different, and Linux changes often, please visit the CircuitPython on Linux guide to get your computer ready ()!

Once that's done, from your command line run the following command:

- `pip3 install adafruit-circuitpython-lsm6ds`

If your default Python is version 3 you may need to run 'pip' instead. Just make sure you aren't trying to use CircuitPython on Python 2.x, it isn't supported!

CircuitPython & Python Usage

To demonstrate the usage of the sensor we'll initialize it and read the acceleration and rotation measurements from the board's Python REPL.

Run the following code to import the necessary modules and initialize the I2C connection with the sensor:

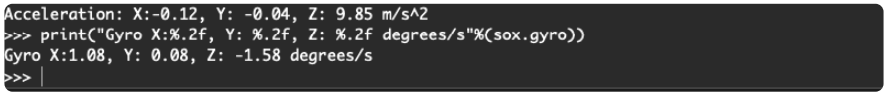
```
import time
import board
import busio
import adafruit_lsm6ds

i2c = busio.I2C(board.SCL, board.SDA)
sox = adafruit_lsm6ds.LSM6DSOX(i2c)
```

Now you're ready to read values from the sensor using these properties:

- acceleration - The acceleration forces in the X, Y, and Z axes in m/s ^{2}
- gyro - The rotation measurement on the X, Y, and Z axes in degrees/sec

For example, to print out the acceleration and gyro measurements use this code:

```
print("Acceleration: X:%.2f, Y: %.2f, Z: %.2f m/s^2" % (sensor.acceleration))
print("Gyro X:%.2f, Y: %.2f, Z: %.2f degrees/s" % (sensor.gyro))
```



That's all there is to it! Go forth and imbue your robot friends with the gift of being able to maybe not fall down all the time. Maybe.

Example Code

```
# SPDX-FileCopyrightText: Copyright (c) 2020 Bryan Siepert for Adafruit Industries
#
# SPDX-License-Identifier: MIT
import time
import board
from adafruit_lsm6ds.lsm6dsox import LSM6DSOX

i2c = board.I2C()  # uses board.SCL and board.SDA
# i2c = board.STEMMA_I2C()  # For using the built-in STEMMA QT connector on a
microcontroller
sensor = LSM6DSOX(i2c)

while True:
    print("Acceleration: X:%.2f, Y: %.2f, Z: %.2f m/s^2" % (sensor.acceleration))
    print("Gyro X:%.2f, Y: %.2f, Z: %.2f radians/s" % (sensor.gyro))
    print("")
    time.sleep(0.5)
```

Python Docs

Python Docs ()

Downloads

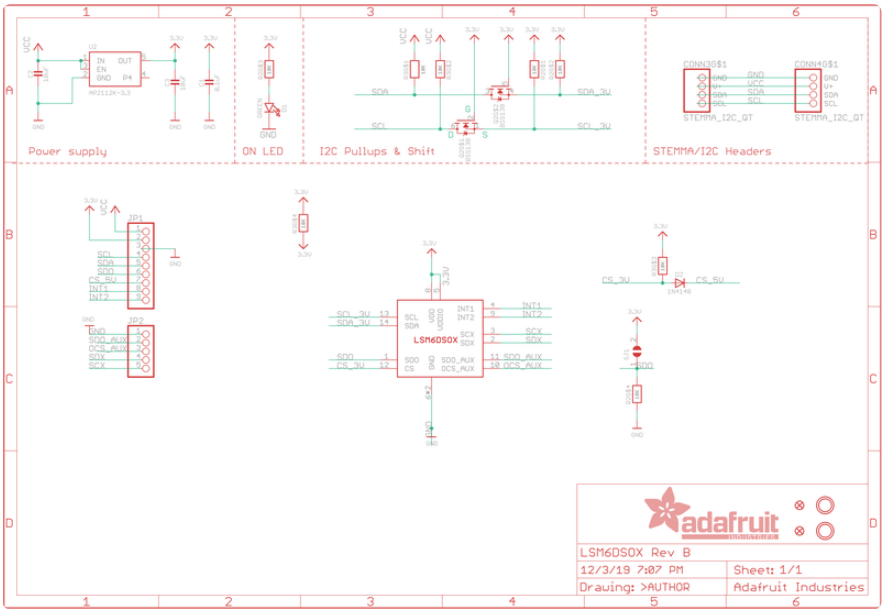
Files

- LSM6DSOX Datasheet ()

- ISM330DHCX Datasheet ()
- LSM6DSO32 Datasheet ()
- EagleCAD files on GitHub ()
- Fritzing object in Adafruit Fritzing Library ()

Schematic

The schematic is identical for the LSM6DSOX, ISM330DHCX, and LSM6DSO32



Fab Print

The fabrication print is identical for the LSM6DSOX and ISM330DHCX