



# Microstack™ Accelerometer

## Getting started

Find out which way is up! Detect taps, flicks, swishes and shakes, make a 3D motion controller or discover how much force has been applied. <http://www.microstack.org.uk>

### Product Highlights

#### Typical applications:

- Orientation sensing - position detection of up, down, left, right, face down, face up.
- User input devices - shake detection, physical movement gestures
- Free fall detection
- Measuring motion - gaming, sports, pedometer, image stabilisation
- Security/audit - shock detection and tamper
- Robotics - course correction/dead-reckoning

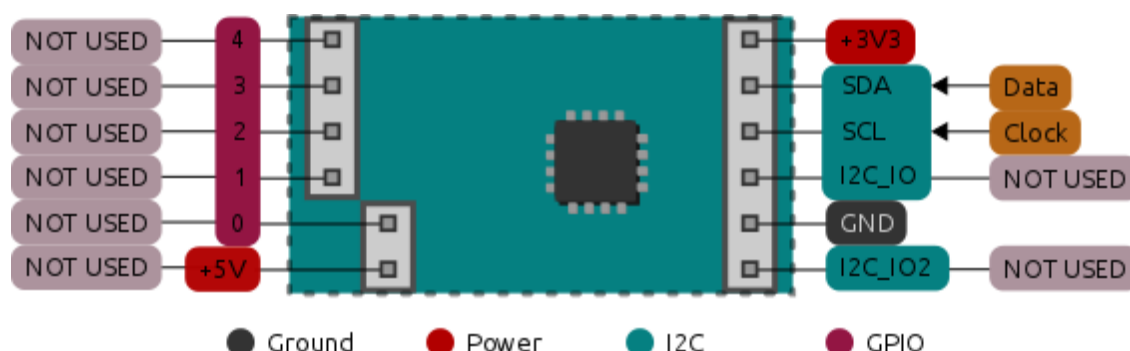
#### Features:

- Low power (6µA to 165µA)
- ±2g/±4g/±8g dynamically selectable ranges
- Can be used with Microstack™ adapter baseboards, including Raspberry Pi®
- Can be used directly in breadboards, prototyping and custom designs

#### Technical Specifications:

- Power 1.95V to 3.6V
- Current Consumption 6µA to 165µA
- Update interval 1.56Hz up to 800Hz (subject to I<sup>2</sup>C bus speed)
- Operating Temp -40° to 85°
- 99µG/√Hz Noise

### Tour of Hardware



**Before using any Microstack™ module always read the instructions and precautions carefully.**

## Fitting Instructions

Carefully line up the pins of the Microstack™ Accelerometer module with sockets on the appropriate baseboard or stackable module, then gently push down. The Accelerometer module is fitted in the blue I<sup>2</sup>C socket. Ensure every pin plugs into a corresponding socket. The Accelerometer is a socket stackable module meaning that additional, other blue I<sup>2</sup>C modules can be stacked on top.

## Hardware

- The jumpers should not be changed as Microstack™ Accelerometer is not user configurable.

## Installing Software Under Linux

Microstack Accelerometer is very easy to use with the Microstack™ Node Python Libraries.

### Installing the Libraries

This guide assumes you are installing on Raspbian on a Raspberry Pi® connected to the Internet to allow you to download packages with apt-get.

Make sure you are using the latest version of Raspbian by opening a terminal and typing:

```
sudo apt-get update
```

To install the Microstack™ Node libraries for Python 3, in a terminal, type the following command:

```
sudo apt-get install python3-microstacknode
```

## Testing

This section shows how to run a sample program installed with the libraries and walks you through creating a simple Python program to read forces.

### Testing the Microstack™ Node Python Libraries

Run the following example program by typing into a terminal:

```
python3  
/usr/share/doc/python3-microstacknode/examples/accelcat.py
```

Which should print something like the following into the terminal:

```
x: 0.05, y: -0.02, z: 0.49
```

As you twist, turn and rotate the Raspberry Pi the numbers should change:



```
x: 0.05, y: -0.02, z: 0.50
x: 0.05, y: -0.02, z: 0.49
x: 0.07, y: -0.05, z: 0.52
x: 0.12, y: 0.45, z: 0.61
x: -0.21, y: 0.08, z: 0.41
x: -0.12, y: 0.09, z: 0.44
x: -0.26, y: 0.00, z: 0.33
x: -0.42, y: 0.20, z: 0.25
x: -0.48, y: 0.16, z: -0.07
x: -0.41, y: 0.20, z: -0.27
```

You may have heard the term 'G' when talking about forces. e.g. "the pilot pulled 3G in that turn"! A force of 1 G is the force of gravity that pulls us to earth. A force of 2G is twice this force of gravity.

To be sensitive enough to detect small forces and big forces, the accelerometer can measure three ranges. The output of the sensor is always a value between -1.0 and 1.0 - representing the minimum and maximum value of the range.

By default, the range of is set to 2G, which means that a value of 1.0 indicates a measured force of 2G (that is twice the ordinary force of gravity). So, when the board is perfectly horizontal and at rest, gravity will be the only force acting on the accelerometer z-axis of the accelerometer. Since 1G is half the maximum force of 2G, the z-axis will read 0.5. Negative values correspond to a force being applied in a negative direction to the axis (for example, when the Accelerometer is upside down).

### Python Functions in Microstack™ Node

Full documentation is provided with the Python module, or online. You can also look at the example code in `/usr/share/doc/python3-microstacknode/examples`.

*Note: These examples below use Python interactively. This is shown by the `>>>` which is presented in the Python interface to indicate it is ready for you to enter a command. Do not type `>>>` before the commands!*

```
>>> import microstacknode.hardware.accelerometer.mma8452q
>>> accelerometer =
microstacknode.hardware.accelerometer.mma8452q.MMA8452Q()
>>> x, y, z = accelerometer.get_xyz()
>>> print('x: {:.2f}, y: {:.2f}, z: {:.2f}'.format(x, y, z))
```

The example code first imports the module, then creates an accelerometer object. The third line reads the accelerometer and stores the force on the three axes into the three variables x,y and z. The final line then prints these values to the screen.



## Warnings

- Microstack™ Accelerometer is not intended for use in life critical systems. Do not rely on it for navigation or safety critical positional information. Do not expose to water, moisture or extremes of temperature.
- Take care whilst handling to avoid mechanical and electrical damage to the module and connectors.
- Take suitable precautions to minimise risk of causing damage by electrostatic discharge.
- Connection to unapproved devices may affect compliance or result in damage to unit and invalidate any warranty.
- Connections to Microstack™ modules should only be made with the power supply disconnected.
- Ensure that Microstack™ modules are powered by a suitably rated power supply that complies with the relevant regulations and standards applicable to the country of intended use.
- It is the user's responsibility to ensure the module is fitted in a suitable enclosure that it offers appropriate protection to ensure safe and proper operation.
- Take care when applying motion to the accelerometer and any mechanically connected devices.

## Compliance Information

- This Microstack™ module complies with the relevant provision of the RoHS Directive for the European Union. In common with all Electronic and Electrical Equipment this Microstack™ module should not be disposed of in household waste. Alternative arrangements may apply in other jurisdictions.
- Microstack™ accelerometer module is CE marked. It is a class B product. The EMC emission test was performed with a Microstack™ baseboard fitted to a Raspberry Pi® Model B+. Due to the nature of the module, as a prototyping and development board, fast transient immunity tests and conducted radio-frequency immunity tests have not been executed. ESD handling precautions should be observed. The module may be considered a component if integrated into another product. Any person designing or developing a product that uses one or more Microstack™ modules is responsible for ensuring that it is compliant and that any modification to a Microstack™ module or inter-connection of other elements and devices with a module does not change compliance.
- This Class B digital apparatus complies with CAN ICES-3 (B). Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.
- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

<http://www.microstack.org.uk>



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Microstack™ is distributed by Premier Farnell UK, 150 Armley Road, Leeds LS12 2QQ, UK

Manufactured in the UK.

Documentation Revision 1.0 October 2014

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