

# Magnetic Calibration

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**Motion** Version 2.2

[www.motionnode.com](http://www.motionnode.com)

[www.motionshadow.com](http://www.motionshadow.com)

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## 1 Introduction

To achieve the most accurate orientation output, it may be necessary to calibrate the MotionNode Inertial Measurement Unit (IMU) for your location or any hardware mounting. The magnetic calibration corrects for any constant offset to the measured intensity of the geomagnetic field.

The offset is caused by proximity to ferromagnetic materials, such as iron and nickel. The source of the offset could be environmental, from the structure of the building you are in, or from the frame of your desk. We recommend an in-location calibration if:

- You are mounting the device to any hardware that contains ferromagnetic material.
- Your application requires extremely accurate absolute orientation measurements.
- The orientation output does not appear to meet the error specification.

The MotionNode software includes orientation output modes that do not use the magnetometer measurements. Use one of these orientation modes to troubleshoot magnetic offsets.

## 2 Procedure

The Motion Service will automatically calibrate the sensors based on a take, a set of recorded data streams. Use the following procedure to get the best calibration, and as a result, the most accurate measurements. The calibration process only requires a couple of minutes.

1. Start a take. The recorded data is used to calibrate the sensors. Run the command **Node > Start Take** (in the user interface).
2. Rotate the MotionNode IMU in space. The more complete the *coverage*, the better the resulting calibration. Think of *coverage* as the total number of orientations you rotate the MotionNode through. See Figure 1 for an example in 2D, on a circle. You will have to work in 3D, on a sphere, but the concept is the same.

The most important orientations to capture are the extrema of each of the three axes, the minimum and maximum values. See Figure 2 for an example in 2D.

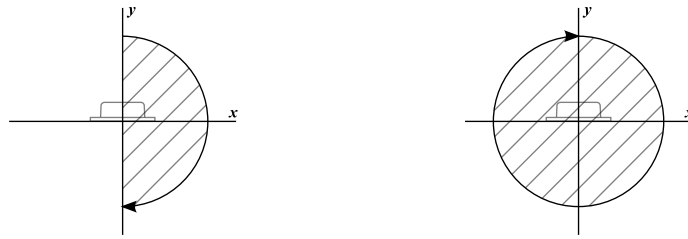


Figure 1: From left to right: 180° of coverage, or 50%. 360° of coverage, or 100%.

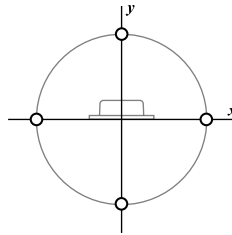


Figure 2: Extrema, minimum and maximum value, of each axis.

Do not worry to much about capturing every orientation and the extrema of every axis. The calibration algorithm finds the best calibration given the the available orientations. The algorithm will still perform well, even without full coverage.

**Note:** Do not simply place the MotionNode sensor flat on your desk to capture the axis extrema. Instead, rotate the sensor continuously to capture many orientations.

3. After you have enough orientation coverage, stop the take and close all connections. Run the command **Node > Close**.
4. Run the calibration procedure for a single MotionNode. Click on the **Id** field of the device you want to calibrate and run the command **MotionNode > Calibrate From Take**. This will generate the new calibration, copy it into the configuration, and associate the new calibration with your current location.

**Note:** To use the new calibration on another computer, you must complete the next step and save it to the MotionNode device memory.

5. *[Optional]* Copy the configuration to the MotionNode device's non-volatile

memory. Run the command **MotionNode > Write Configuration**.  
Now the device has a permanent copy of the new calibration.

The Motion Service maintains a calibration for each device in each location. When you generate a new calibration it is stored in a database on your computer. A user calibration takes precedent over the default calibration stored on the MotionNode device.