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http://hobbylogs.me.pn/

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Compass header file description

This header will only work for HMC5883L Magnetometer with I2C address of 0x1E. It is configured for single measurement. This means when the *compass_scalled_reading()* function is called, the HMC5883L is woken up and measurement is taken and then put back in sleep mode. Moreover, the measurements are averaged by 8 samples and is hardcoded.

compass.h, require #include <Wire.h> before #include "compass.h". Moreover, it also require to initialize I2C port by writing command "Wire.begin();" before calling any of the given functions.

Global Variables

The header file will pass these variables as Global Variables

float bearing	(Angle from Magnetic North in degrees)
float compass_x_scalled	(Magnetic field in x-axis in milli guass)
float compass_y_scalled	(Magnetic field in y-axis in milli guass)
float compass_z_scalled	(Magnetic field in z-axis in milli guass)
float compass_x_offset	(Magnetic field measurement offset in x-axis used for calibration)
float compass_y_offset	(Magnetic field measurement offset in y-axis used for calibration)
float compass_z_offset	(Magnetic field measurement offset in z-axis used for calibration)
float compass_x_gainError	(Magnetic field gain error in x-axis used in calibration)
float compass_y_gainError	(Magnetic field gain error in y-axis used in calibration)
float compass_z_gainError	(Magnetic field gain error in z-axis used in calibration)

Functions

compass_offset_calibration(int select) This function is used for the calibration of the Magnetometer. It accepts three inputs 1,2 and 3.
select=1: Magnetometer is calibrated for the error in the gain in the measurement. compass_x_gainError, compass_y_gainError and compass_z_gainError variables are updated.
select=2: Magnetometer is calibrated for the error in the offset in the measurement. compass_x_offset, compass_y_offset and compass_z_offset variables are updated.
select=3: Magnetometer is calibrated for both the gain and offset in the measurement.
select=any: Magnetometer is not calibrated and initial values of compass_x_gainError, compass_y_gainError, compass_z_gainError, compass_x_offset, compass_y_offset and compass_z_offset are used in the calculation of *compass_scalled_reading()* function.

compass_init(int gain) This gain will set the gain of the magnetometer.
gain=0: max scale = 0.73 gauss
gain=1: max scale = 0.92 gauss
gain=2: max scale = 1.22 gauss
gain=3: max scale = 1.52 gauss

<div align="right">

gain=4: max scale = 2.27 gauss
gain=5: max scale = 2.56 gauss
gain=6: max scale = 3.03 gauss
gain=7: max scale = 4.35 gauss

</div>

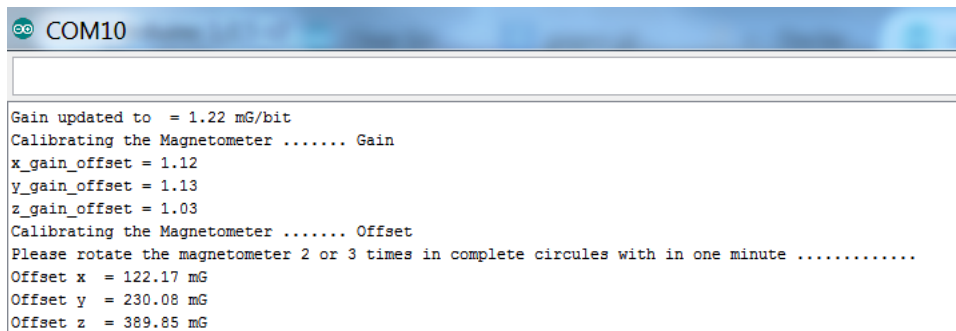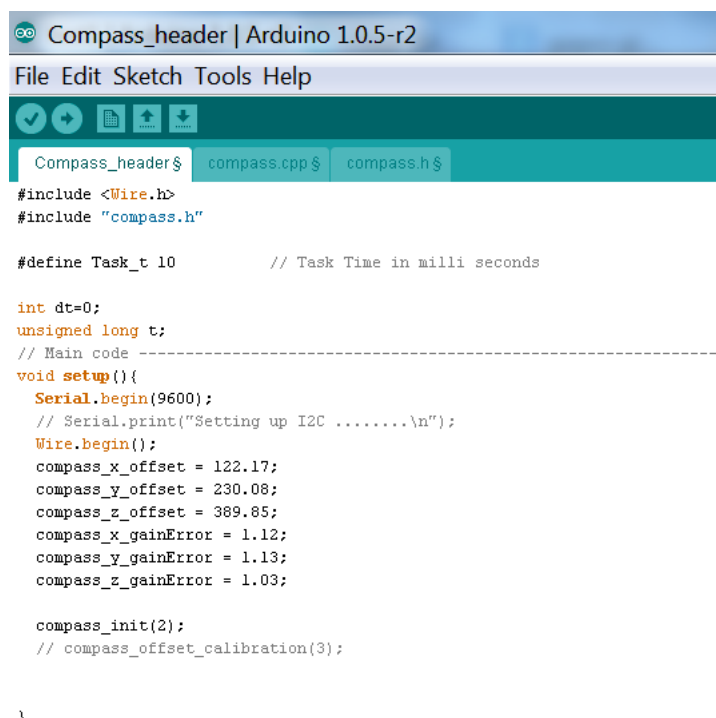|	
compass_scalled_reading()	Calling this function will update compass_x_scalled, compass_y_scalled and compass_z_scalled with the latest measurements.
compass_heading()	This function will update compass_x_scalled, compass_y_scalled, compass_z_scalled and bearing

Calibration importance

The magnetic north calculation will be not correct until the measurements are not calibrated, especially for the constant offset in the measurement. The biggest factor effecting this error is the electronics around it (including on breakout board). So you cannot get rid of it and as long as the hardware around HMC5883L is same, the error more or less will remain the same. It is a good idea to re-calibrate the magnetometer every time the hardware is changed. The calibration results are shown in Figure 1.

```
COM10

Gain updated to  = 1.22 mG/bit
Calibrating the Magnetometer ....... Gain
x_gain_offset = 1.12
y_gain_offset = 1.13
z_gain_offset = 1.03
Calibrating the Magnetometer ....... Offset
Please rotate the magnetometer 2 or 3 times in complete circules with in one minute ............
Offset x  = 122.17 mG
Offset y  = 230.08 mG
Offset z  = 389.85 mG
```

Figure 1: Calibration results

These results can be saved, and used in the start of the Arduino Sketch by putting these variables compass_x_gainError, compass_y_gainError, compass_z_gainError, compass_x_offset, compass_y_offset and compass_z_offset as constant and comment out the calibration function as shown in Figure 2.

```
Compass_header | Arduino 1.0.5-r2

File Edit Sketch Tools Help

Compass_header §   compass.cpp §   compass.h §

#include <Wire.h>
#include "compass.h"

#define Task_t 10          // Task Time in milli seconds

int dt=0;
unsigned long t;
// Main code --------------------------------------------------------
void setup(){
  Serial.begin(9600);
  // Serial.print("Setting up I2C ........\n");
  Wire.begin();
  compass_x_offset = 122.17;
  compass_y_offset = 230.08;
  compass_z_offset = 389.85;
  compass_x_gainError = 1.12;
  compass_y_gainError = 1.13;
  compass_z_gainError = 1.03;

  compass_init(2);
  // compass_offset_calibration(3);


}
```
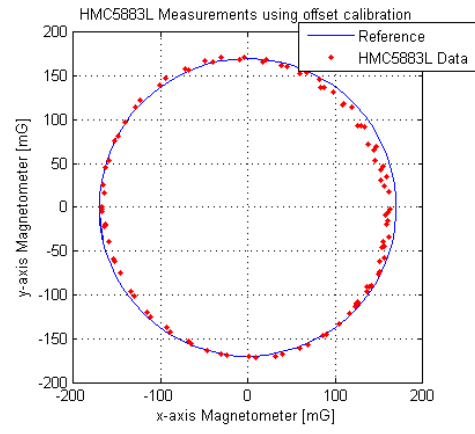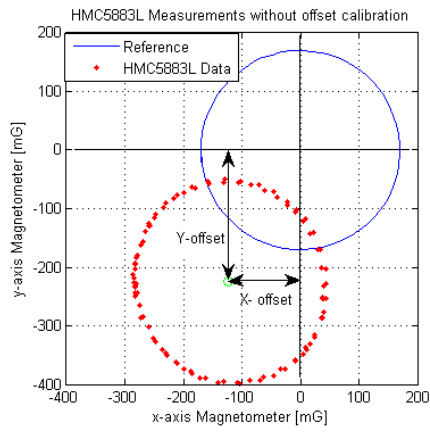
Figure 2: Arduino Sketch with constant errors

Figure 3: Comparison between calibrated and non-calibrated HMC5883L

A comparison is shown for only x and y data in Figure 3 for the calibration performed in Figure 1