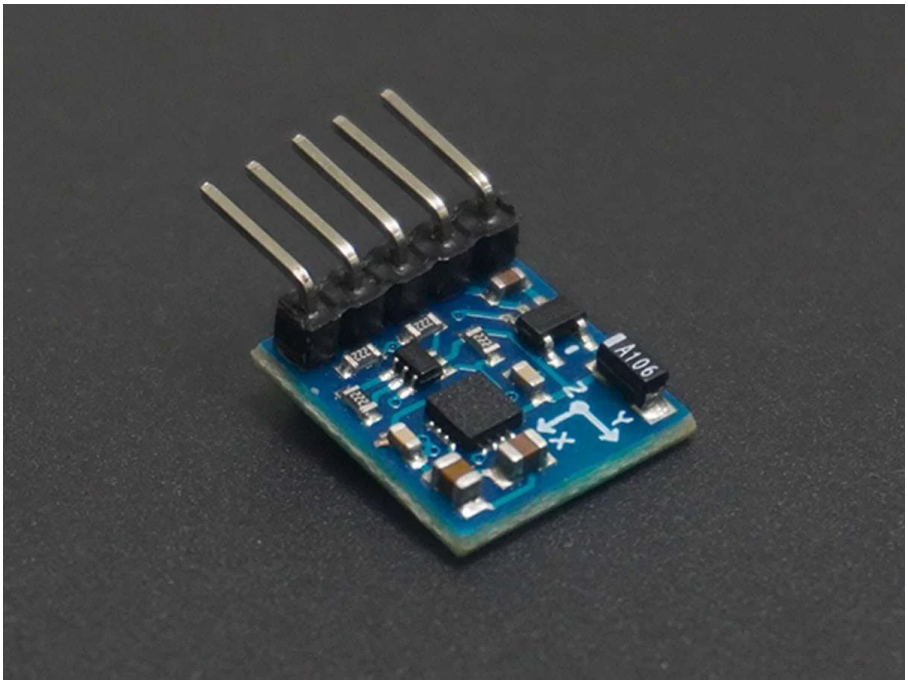
Triple Axis Magnetometer HMC5883L interfacing with AVR ATmega16

Overview of Magnetometer



HMC5883L Magnetometer Module

HMC5883L is a 3-axis magnetometer that is used for measuring the direction and magnitude of the Earth's magnetic field. It is used for low cost compassing and magnetometry.

It measures the Earth's magnetic field value along the X, Y, and Z axes from milli-gauss to 8 gauss.

It can be used to find the direction of the heading of the device.

It uses the I2C protocol for communication with the microcontroller.

For more information about Magnetometer HMC5883L and how to use it, refer to the topic **HMC5883L Magnetometer Module** (http://electronicwings.com/sensors-modules/hmc5883l-magnetometer-module) in the sensors and modules section.

Programming for HMC5883L Magnetometer

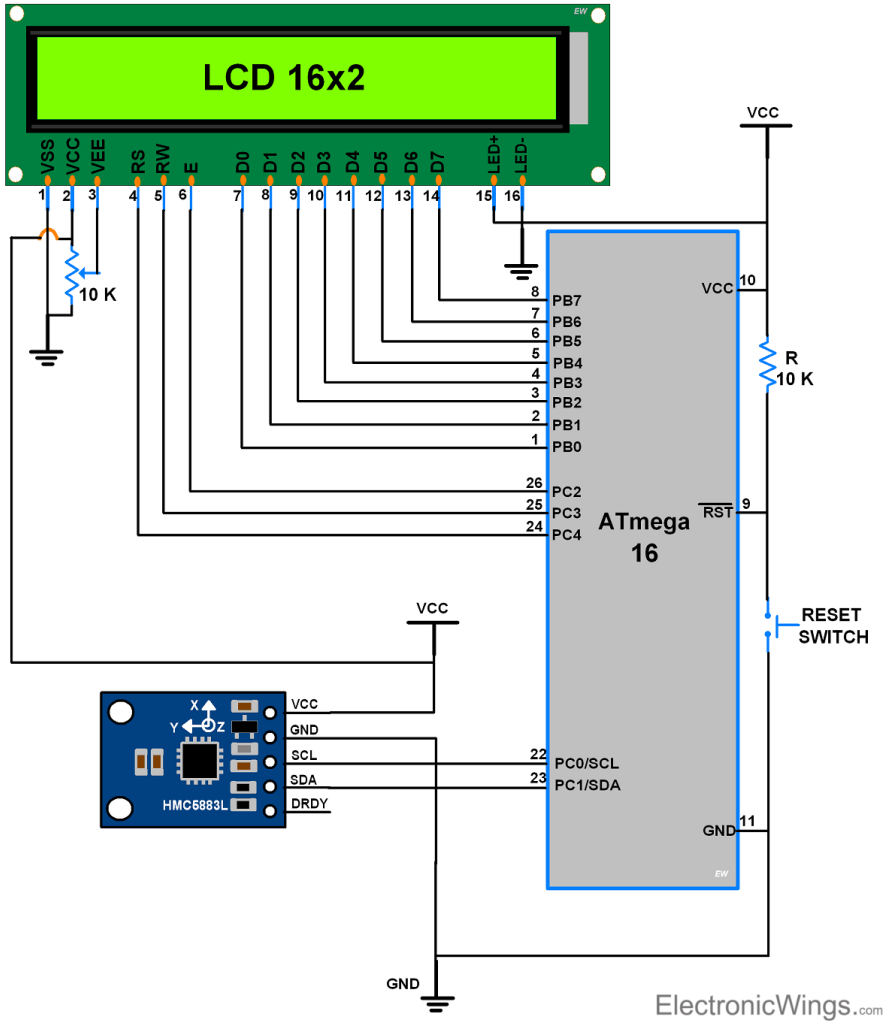
Let's interface the triple-axis magnetometer HMC5883L module with AVR ATmega16 and calculate its heading angle.

HMC5883L uses the I2C protocol for communication. Here we are connecting AVR based ATmega16 as a master device and HMC5883L as a slave device. Its I2C device address is 0x3C. Its read and write operation addresses are:

Slave device write address (SLA+W): `0x3C`

Slave device read address (SLA+R): `0x3D`

Connection Diagram of HMC5883L with ATmega16/32



Interfacing HMC5883L Magnetometer Module With ATmega 16

HMC5883L Programming steps

First, we need to set configuration register A for an average of 8-sample measurement with a 15 Hz default data output rate

Set Gain using Configuration Register B i.e. here it's 0xA0. (or we can choose any other desired gain)

Select Continuous measurement mode of operation in Mode Register. Hence Mode Register value will become 0x00.

After initialization, Write the start location of output data registers X, Y, and Z i.e. 0x03, and read all six registers' raw values.

Calculate the Heading value by using the formula,

$$MagneticHeading = atan2(\frac{y}{x})$$

(Radian)

True Heading = Magnetic Heading + declination Angle (Radian)

HMC5883L Magnetometer Code for ATmega16/32

```
/*
 * ATmega16_Magnetometer.c
 * http://www.electronicwings.com
 *
 */

#define F_CPU 8000000UL             /* Define CPU Frequency e.g. here its 8MHz
#include <avr/io.h>             /* Include AVR std. library file */
#include <stdlib.h>             /* Include std. library file */
#include <math.h>               /* Include math header file */
#include "LCD_16x2_H_file.h"    /* Include LCD header file */
#include "I2C_Master_H_file.h"  /* Include I2C header file */
#define PI      3.14159265359   /* Define Pi value */
#define Declination     -0.00669/* Define declination of location from where mea

void Magneto_init()             /* Magneto initialize function */
{
        I2C_Start(0x3C);            /* Start and write SLA+W */
        I2C_Write(0x00);            /* Write memory location address */
        I2C_Write(0x70);            /* Configure register A as 8-average, 15 Hz
        I2C_Write(0xA0);            /* Configure register B for gain */
```

Note that heading also gets affected by device tilt and nearby magnetic devices effect. There are compensating methods provided in the attached document.

Video of HMC5883L Magnetometer Angle Measurement using ATmega16/32

Components Used

Powered By MOUSER ELECTRONICS (https://www.mouser.in?utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

ATmega 16 ATmega 16	X 1	(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA16L-8PU?qs=%2Fha2pyFaduiGCJtTvs2wv8fVZbVAalLu7Iq%2FglTS0tALAx6fMenLvg%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/atmega-16/1/datasheet)

Components Used

Atmega32 Atmega32	X 1	(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA32-16PU?qs=aqrrBurbvGdpkmgj7RWmsQ%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/atmega32/1/datasheet)
HMC5883L Magnetometer Module Magnetometer HMC5883L is developed by Honeywell...	X 1	(https://www.mouser.in/ProductDetail/Olimex-Ltd/MOD-HMC5883L?qs=%2Fha2pyFaduiM2FizGGE3eZs8JvW%2Fsm6fbEJBqFTwYwfN63cbOSCmqA%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

Components Used

LCD16x2 Display LCD16x2 Display	X 1	(https://www.mouser.com/ProductDetail/Adafruit/1447?qs=XAKIUOoRPe6AClmsjw7y7g%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

Downloads

ATmega16 Magnetometer Project file	Dow nloa d (/api/download/platform-attachment/153)
Applications of Magnetic Sensors for Low Cost Compass Systems	Dow nloa d (/api/download/platform-attachment/154)
Applications of Magneto-resistive Sensors in Navigation Systems	Dow nloa d (/api/download/platform-attachment/155)
HMC5883L 3-Axis Digital Compass IC	Dow nloa d (/api/download/platform-attachment/156)

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