

Aurduino Based Gauss Meter

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Abstract—

Presented here is a handled device that can be used to measure magnetic field using a Hall Effect based sensor. The device can be used in the physics lab for conducting various experiments on magnetism. Moreover, some upgradations can be made to develop new & advanced devices. The device shows magnetic field in CGS (centimeter-gram-second system) units, Gauss & is updated every 250 milliseconds on the LCD screen1.

Introduction

Nowdays MCP3202 (12-bit A/D converter). The Microchip Technology's MCP3202 is a successive approximation 12-bit A/D converter with an on-board sample-and-hold circuit. It is programmed to provide a single pseudo -differential input pair or dual single-ended inputs. Differential non-linearity (DNL) is specified at +1 LSB (MCP3202-B) & +2 LSB, (MCP3202) versions. Communication with the device is done using a simple serial interface compatible with SPI protocol. The device is capable of version rates of up to 100ksps at 5V & 50ksps at 2.7V. the MCP3202 device operates over a broad voltage range of 2.7V to 5.5V. low current design permits operation with typical standby & active currents of only 500nA & 375uA, respectively.

2. CIRCUIT DESIGN:

1. arduino based gauss meter

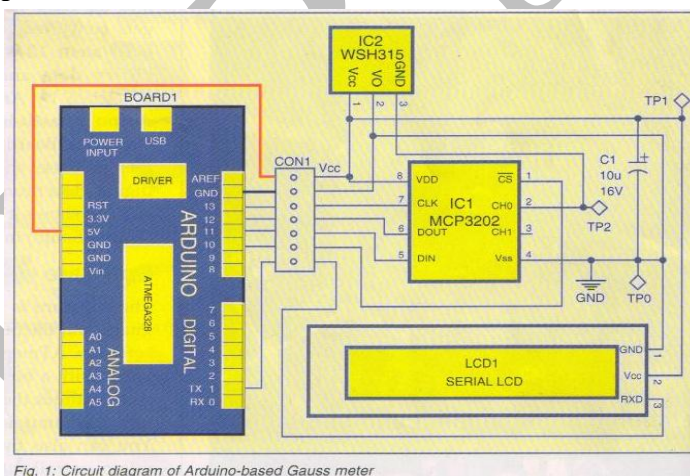
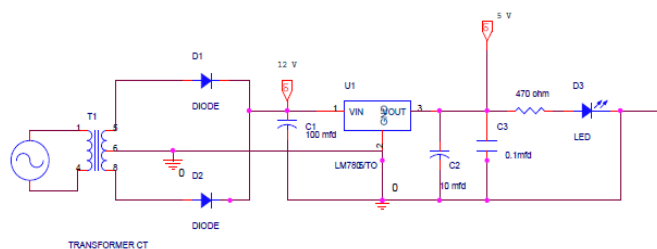


Fig. 1: Circuit diagram of Arduino-based Gauss meter

2. Power supply circuit



POWER SUPPLY

3. COMPONENTS USED:

A. Semiconductors:

- IC1 - MCP3202,12-bit ADC
- IC2 - WSH315,Hall-effect sensor
- LCD1 - 16x2 serial LCD

B. Capacitor:

- C1 - 10µF,16V electrolytic

C. Miscellaneous:

- BOARD1 - ArduinoUno Bard
- CON1 - 7-pin connector
- Pcb

BATTERIES AND CONNECTORS

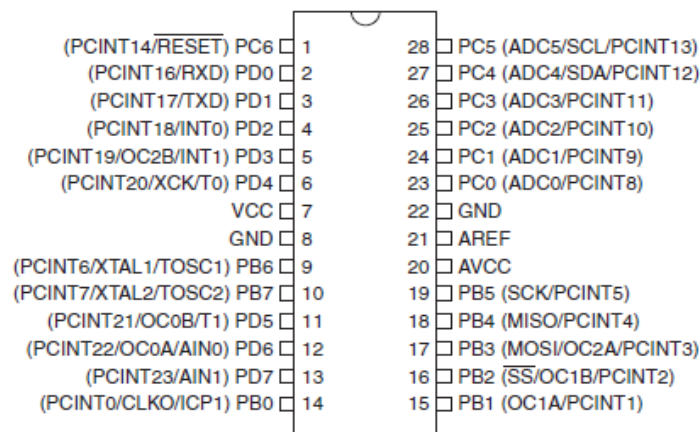
4. ATmega-328 MICROCONTROLLER:

The high-performance Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed. Mid range devices have 14-bit bus, most PIC12F and PIC16F series.

Features

- High Performance, Low Power AVR 8-Bit Microcontroller
- Advanced RISC Architecture
- 131 Powerful Instructions – Most Single Clock Cycle Execution
- 32 x 8 General Purpose Working Registers
- Fully Static Operation
- Up to 20 MIPS Throughput at 20 MH

PIN DIAGRAM:



5. RF Module :

CC2500 RF Module is a transceiver module which provides easy to use RF communication at 2.4 GHz. It can be used to transmit and receive data at 9600 baud rates from any standard CMOS/TTL source. This module is a direct line in replacement for your serial communication it requires no extra hardware and no extra coding toIt works in Half Duplex mode i.e. it provides communication in both directions, but only one direction at same time

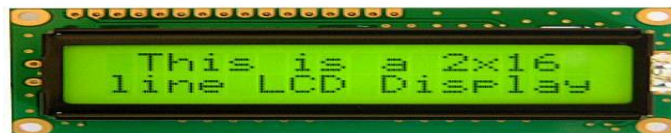
- Input Voltage - 5Volts DC
- Baud Rate - 9600
- RS 232 Interface & TTL Interface
- Range – Max 30 Mtrs - Line of Sight



LIQUID CRYSTAL DISPLAY (LCD):

Basic diagram of LCD is as shown in figure and description of its layers as follows:

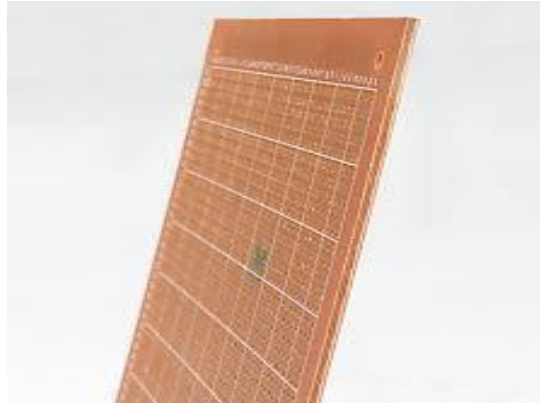
1. Polarizing filter film with a vertical axis to polarize light as it enters.
2. Glass substrate with ITO electrodes. The shapes of these electrodes will determine the shapes that will appear when the LCD is turned ON. Vertical ridges etched on the surface are smooth.
3. Twisted liquid crystal.
4. Glass substrate with common electrode film (ITO) with horizontal ridges to line up with the horizontal filter.
5. Polarizing filter film with a horizontal axis to block/pass light.
6. Reflective surface to send light back to viewer. (In a backlit LCD, this layer is replaced with a light source.)



PCB PLATE :

PCB is a platform where many of the embedded systems to be made. PCB (Printed Circuit Board) is used for the assembly of various components on a single plate. The connections on the PCB should be identical to the

circuit diagram, but while the circuit diagram is arranged to be readable, the PCB layout is arranged to be functional, so there is rarely any visible correlation between the circuit diagram and the layout. PCB layout can be performed manually (using CAD) or in combination with an Autorouter. The best results are usually still achieved using at least some manual routing. Sometimes abbreviated PCB, a thin plate on which chips and other electronic components are placed. Computers consist of one or more boards, often called cards or adapters

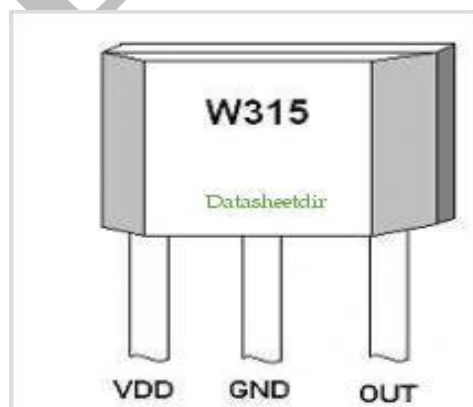


A PCB is a printed circuit board, also known as a printed wiring board. It is used in electronics to build electronic devices. A PCB serves two purposes in the construction of an electronic device; it is a place to mount the components and it provides the means of electrical connection between the components.

Hall effect sensor (wsh315):

The **WSH315** is a new version of WSH135 with better measuring range and thermal shift. It integrates Hall sensing element, linear amplifier, sensitivity controller and emitter follower output stage. It accurately tracks extremely small change in magnetic flux density –generally too small to operate Hall effect Switch By **Winson Semiconductor Corp.**

W315 can be applied as current sensor, tooth sensor, proximity detectors and motion detectors. As sensitive monitor of magnetic flux, it can effectively measure a system's performance with negligible system loading while providing isolation from contaminated and electrically noisy environments.



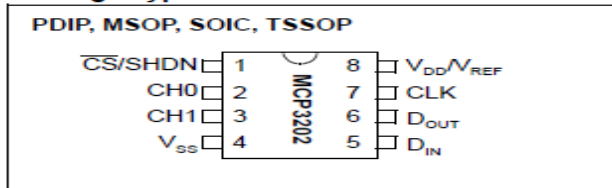
ABSOLUTE MAXIMUM RATING

Supply Voltage, V _{DD} -----	14V
Magnetic Flux Density, B -----	Unlimited
Output Driving Current -----	0.4mA
Operating Temperature Range	
T _a -----	-40°C to +125°C
Storage Temperature Range	
T _s -----	-65°C to +150°C
Power Dissipation P _d	
TO-92S -----	450mW
SOT-23 -----	350mW

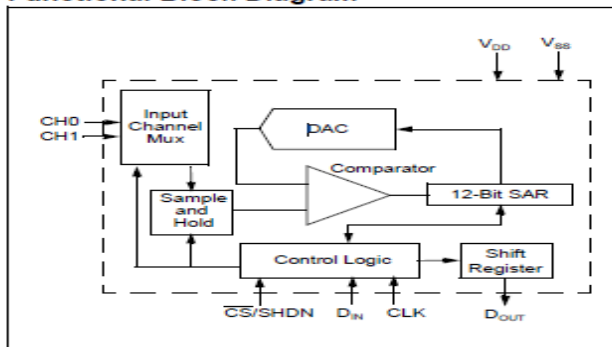
Mcp3202:

The Microchip Technology Inc. MCP3202 is a successive approximation 12-bit Analog-to-Digital (A/D) Converter with on-board sample and hold circuitry. The MCP3202 is programmable to provide a single pseudo differential input pair or dual single-ended inputs. Differential Nonlinearity (DNL) is specified at ±1 LSB, and Integral Nonlinearity (INL) is offered in ±1 LSB (MCP3202-B) and ±2 LSB (MCP3202-C) versions. Communication with the device is done using a simple serial interface compatible with the SPI protocol. The device is capable of conversion rates of up to 100 ksp/s at 5V and 50 ksp/s at 2.7V. The MCP3202 device operates over a broad voltage range (2.7V-5.5V). Lowcurrent design permits operation with typical standby and active currents of only 500 nA and 375 µA, respectively. The MCP3202 is offered in 8-pin MSOP, PDIP, TSSOP and 150 mil SOIC packages.

Package Types



Functional Block Diagram



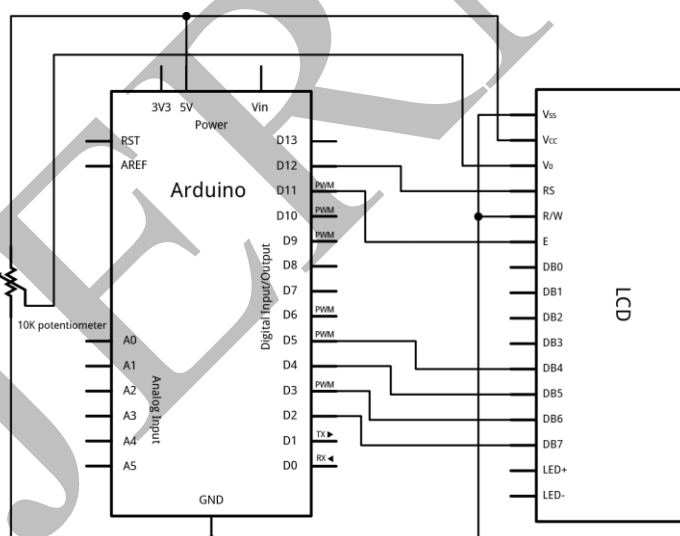
BATTERIES AND CONNECTORS:

A nine-volt battery, sometimes referred to by its original designation as a PP3 battery is used here, the battery has both the positive and negative terminals on one end. The negative terminal is fashioned into a snap fitting which mechanically and electrically connects to a mating terminal on the power connector. The power connector has a similar snap fitting on its positive terminal which mates to the battery. This makes battery polarization obvious since mechanical connection is only possible in one configuration. The clips on the 9-volt battery can be used to connect several 9-volt batteries in series. Inside a PP3 there are six cells, either cylindrical alkaline or flat carbon-zinc type, connected in series. Some brands use welded tabs internally to

attach to the cells, others press foil strips against the ends of the cells. Finally we will connect this assembly with a 9 volts PP3 dry battery; we find it experimentally that RTC will work with low voltage supplies. As mentions in the circuit diagram we connect it to the appropriate space.



BLOCK DIAGRAM:



CONCLUSION

From the research and analysis of our project entitled as “ARDUINO BASED GAUSS METER”, it has proved to remove the disadvantages of traditional method of controlling the home automation. It enables users to remotely control their home appliances and systems using a cell phone-based interface. It can be concluded that this project will not only help in home and industrial automation appliances companies but it will also prove useful on the customer end as well.

The project achieves the following goals

- To co-ordinate appliances and other devices through programming language.
- To effectively receive and sense the magnetic field.

- To eliminate the need of being physically present in any location for tasks involving the operation of appliances within a household/office.
- Minimize power and time wastage.

The system specification shows the description of the function and the performance of system and the user. The scope of our project “Arduino Based Gauss Meter” is immense.

The future implications of the project are very great considering the amount of time and resources it saves. The project we have undertaken can be used as a reference or as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates, device synchronization, etc. The project itself can be modified to achieve a complete Home Automation system which will then create a platform for the user to interface between himself and the household.

REFERENCES

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2. Arnason, H. H..History of Modern Art. 5th ed Upper Saddle River, NJ: Prentice Hall, 2004
3. Banzi, Massimo. Getting Started with Arduino. Sebastopol: O'Reilly, 2009

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