Special Sensor Technical Report

Devantech CMPS03 Magnetic Compass Module

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INTRODUCTION

The use of a compass module is necessary in many self navigating robots. The digital compass module provides bearing information (typically only accurate when used level with the Earth). As incorporated in the StalkBot robot, the compass is used in conjunction with a photoreflector (as a shaft encoder) to do relative navigation.

The following document provides the information necessary for use of the Devantech CMPS03 magnetic compass module.

AVAILABILITY

The Devantech CMPS03 magnetic compass module was purchased through an internet vendor called Acroname, Inc. (4894 Sterling Drive, Boulder CO, 80301-2350, phone: 720-564-0373). Their website is http://www.acroname.com. The Acroname part number is R117-COMPASS. Their purchase price is $46.00 plus additional shipping charges.

CIRCUIT OPERATION

This component's timing pulse is used communicate with the microcontroller (as no I^2C interface is available on the Atmel ATmega103). The SCL and SDA lines (pins 2 and 3) must be pulled high. The LED and 3.3kΩ resistor are connected to the PWM output so that the operation of the device can be seen. The LED can be removed without affect. The 10μF capacitor is placed near the compass to reduce the effects of the 400mA current spikes. Nominally the compass draws 10mA of current. This circuit schematic can be seen in Figure 1.

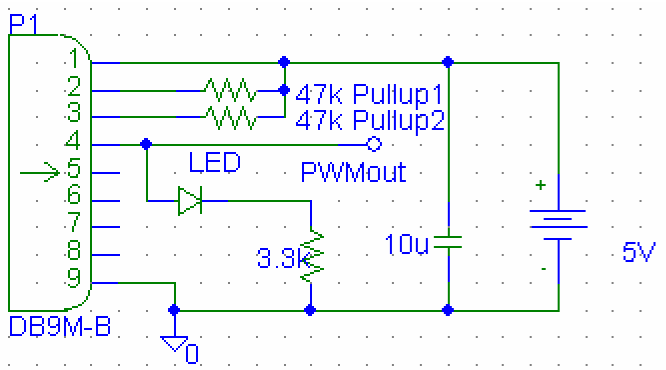

Figure 1: Compass Circuit Design

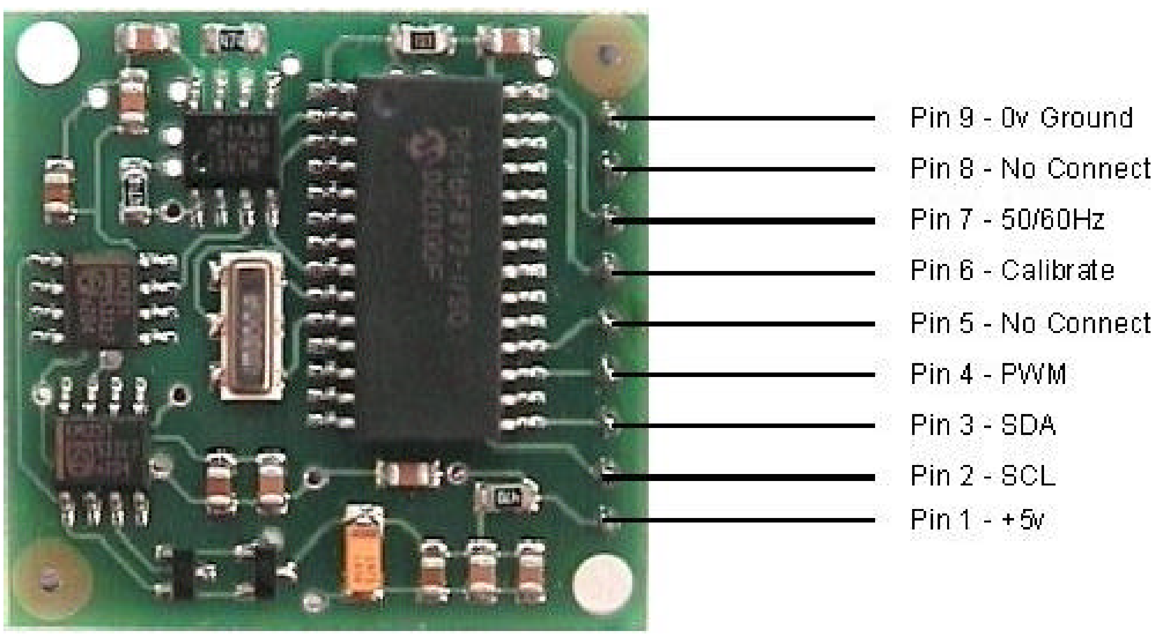

Figure 2: Devantech CMPS03 photo

Figure 2 shows a photo of the Devantech CMPS03 magnetic compass module. The side opposite the pins faces north. The device is calibrated by connecting ground to the calibrate pin. While calibrate is held low, a full rotation must be done slowly from north to east to south to west, and then back to north.

Voltage	5v
Current	20mA Typ.
Resolution	0.1 Degree
Accuracy	3-4 Degrees approx (after calibration)
Output 1	Timing Pulse 1mS to 37mS in 0.1mS increments
Output 2	I2C Interface, 0-255 and 0-3599
SCL Speed	up to 1MHz
Weight	0.03 oz.
Size	32mm x 35mm

Figure 3: Devantech CMPS03 details

After proper calibration the compass module has 3-4 degree accuracy with 0.1 degree resolution. These figures are good enough for crude relative navigation. The interface to the compass is simple and can be easily read using a microcontroller input capture pin.

C CODE

The avrgcc compiler was used to compile and run the code segments on an Atmel ATmega103 microcontroller. The compass was connected to the input capture 1 pin. The code reads the compass module continuously and outputs the least significant portion of the pulse width to PORTC forever. The microcontroller used was running at 6 MHz.

```
#include <io.h>

#include <sig-avr.h>

#include <interrupt.h>

typedef unsigned short u16;


// global compass variables

u16 risingedge;

volatile u16 compasswidth;


void initports(void) {

     // Set input capture pin as input

     outp(0x00,DDRD);

}

SIGNAL(SIG_INPUT_CAPTURE1){

     // IC1_ISR, if set to capture rising edge

     if(TCCR1B & (1<<ICES1))

          risingedge = ICR1; // save rising edge

     else

          compasswidth = ICR1 - risingedge;

     // otherwise was falling edge, calculate pulse width

     // Toggle the edge trigger bit

     outp(TCCR1B ^ (1<<ICES1), TCCR1B);

}

void inittimers(void) {
```

```
    // Turn on timer1 input capture interrupt
    outp(0x20, TIMSK);
    // Set counter1 at CLK / 64, and wait for rising edge
    outp(0xC3, TCCR1B);
}
int main(void){
    initports();
    inittimers();
    sei();  // turn on global interrupts
    while(1){ // Repeat forever
        // output the least significant 8 bits to PORTC
        outp(compasswidth, PORTC);
    }
}
```