

# Design Assignment 3B

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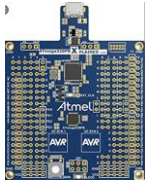
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Primary Github address: [https://github.com/MeralAbuJaser/Submission\\_da.git](https://github.com/MeralAbuJaser/Submission_da.git)

Directory: [https://github.com/MeralAbuJaser/Submission\\_da/tree/master/DA3B](https://github.com/MeralAbuJaser/Submission_da/tree/master/DA3B)

## 1. COMPONENTS LIST AND CONNECTION BLOCK DIAGRAM w/ PINS



Atmega 328pb

### Atmel Studio 7.0

- debugger
- simulator
- assembler
- programmer
- data visualizer

### ATmega328PB

- FTDI chip
- USART

### Additional components

- LM35

### Pin-out

Figure 5-1. 28-pin PDIP



## 2. INITIAL/MODIFIED/DEVELOPED CODE OF TASK 1/A

```
#define F_CPU 16000000UL
#define BAUD 9600
#include <stdio.h>
#include <util/delay.h>
#include <util/setbaud.h>
#include <avr/interrupt.h>
#include <avr/io.h>

volatile float adc_fah; //declare float value for Fahrenheit temp
volatile float adc_cel; //declare float value for celcius temp
volatile float temp;

void USART_init(void){
    UBRR0H = UBRRH_VALUE;
    UBRR0L = UBRL_VALUE;
    UCSRC = _BV(UCSZ01) | _BV(UCSZ00); //8-bit data
    UCSRB = _BV(RXEN0) | _BV(TXEN0); //Enable RX and TX
}

//Send data to the serial port
void USART_tx_string( char *data ){
    while ((*data != '\0')){ //while the register is empty enter date
        while (!(UCSR0A & (1 << UDRE0)));
        UDR0 = *data;
        data++; //increment data location forward
    }
}

void read_adc(void){
    unsigned char i = 10;
    adc_fah = 0;
    adc_cel = 0;
    temp = 0;
    while(i--){
        ADCSRA |= (1 << ADSC);
        while(ADCSRA & (1 << ADSC));
        temp += ADC;
    }
    adc_fah = (temp/6)-4; //convert ADC value to fahrenheit
    adc_cel = (temp/18); //convert fahrenheit to celcius
}

ISR(TIMER0_OVF_vect){
    char fahrenheit[20]; //character array for fahrenheit degree
    char celcius[20]; //character array for celcius degree

    for (int i = 0; i <= 30; i++) {
        while (TCNT0 != 255) {} // loop runs until TCNT = 255
        TCNT0 = 0; // reset TCNT
    }
    read_adc();

    USART_tx_string("Fahrenheit degree: ");
    snprintf(fahrenheit, sizeof(fahrenheit), "%f\r\n", adc_fah); //stores the value in the array
    USART_tx_string(fahrenheit); //prints the fahrenheit value

    USART_tx_string("Celcius degree: ");
    snprintf(celcius, sizeof(celcius), "%f\r\n", adc_cel); //stores the value in the array
    USART_tx_string(celcius); //prints the celsius value
    USART_tx_string("\n\n");

    TCNT0 = 0;
}
```

```

// Initialize ADC
void adc_init(void) {
    /**Setup and enable ADC**/
    ADMUX = (0<<REFS1) | //Reference selection bits
    (1<<REFS0) | //AVcc - external cap at AREF (5)V
    (0<<ADLAR) | //ADC right adjust result
    (1<<MUX2) | //Analog channel selection bits
    (0<<MUX1) | //ADC4 (PC4 PIN27)
    (0<<MUX0);

    ADCSRA = (1<<ADEN) | //ADC enable
    (0<<ADSC) | //ADC start conversion
    (0<<ADATE) | //ADC auto trigger enable
    (0<<ADIF) | //ADC interrupt flag
    (0<<ADIE) | //ADC interrupt enable
    (1<<ADPS2) | //ADC Prescaler select bits
    (1<<ADPS1) | //128 AS PRESCALAR SELECTION BIT
    (1<<ADPS0); //Select channel
}

int main(void){
    USART_init(); //call function to initialize
    TCCR0A = 0x00; //normal mode timer
    TCCR0B = 0x05; //set pre0scaler = 1024
    TCNT0 = 0; //counter = 0
    TIMSK0 = (1<<TOIE0); //enable interrupt
    sei(); //enable global
    adc_init();//initialize adc

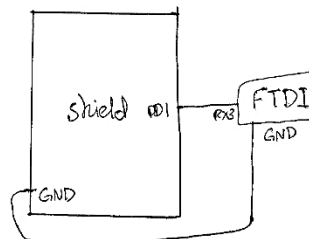
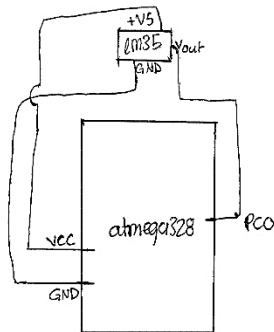
    while(1){}
}

```

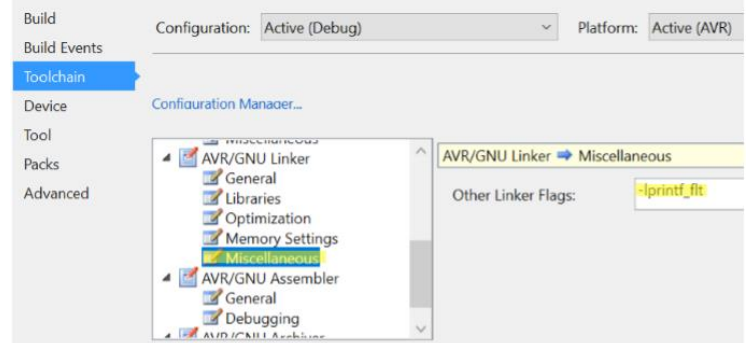
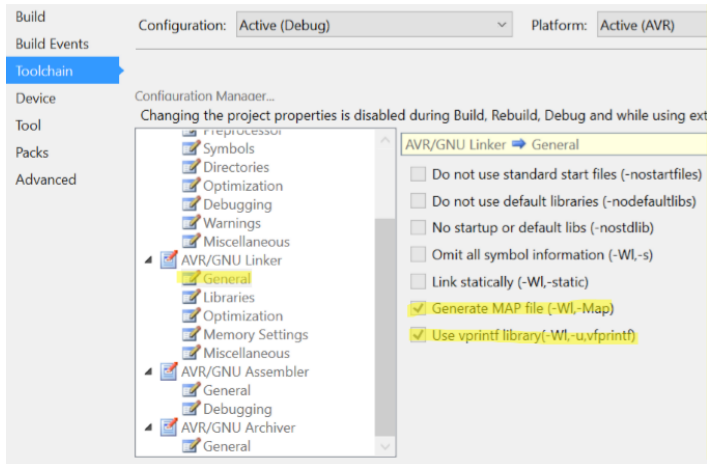
### 3. DEVELOPED MODIFIED CODE OF TASK 2/A from TASK 1/A

N/A

### 4. SCHEMATICS



## 5. SCREENSHOTS OF EACH TASK OUTPUT (ATMEL STUDIO OUTPUT)



to display the floating-point value and not “?”

The output of the temperature in both F and C through the data visual terminal

```
Fahrenheit degree: 87.666664
Celcius degree: 30.555555
```

```
Fahrenheit degree: 87.333336
Celcius degree: 30.444445
```

```
Fahrenheit degree: 87.500000
Celcius degree: 30.500000
```

```
Fahrenheit degree: 88.166664
Celcius degree: 30.722221
```

```
Fahrenheit degree: 95.166664
Celcius degree: 33.055557
```

```
Fahrenheit degree: 95.333336
Celcius degree: 33.111111
```

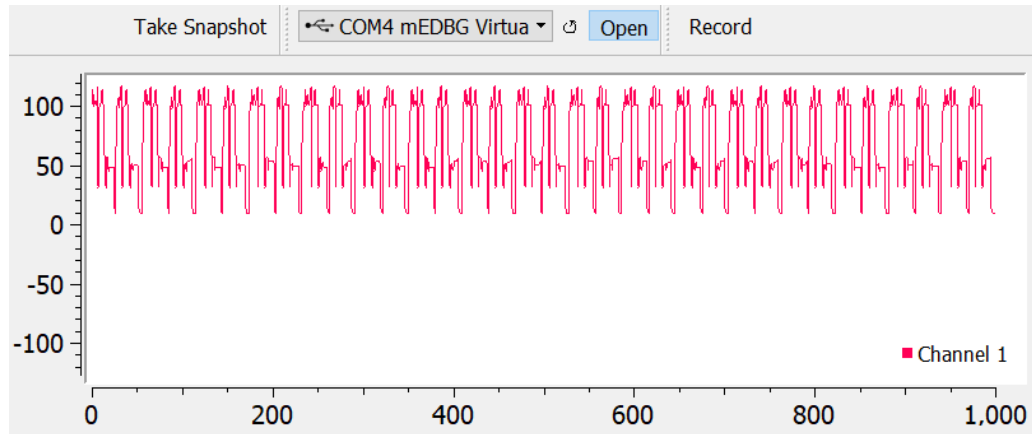
```
Fahrenheit degree: 94.666664
Celcius degree: 32.888889
```

```
Fahrenheit degree: 94.833336
Celcius degree: 32.944443
```

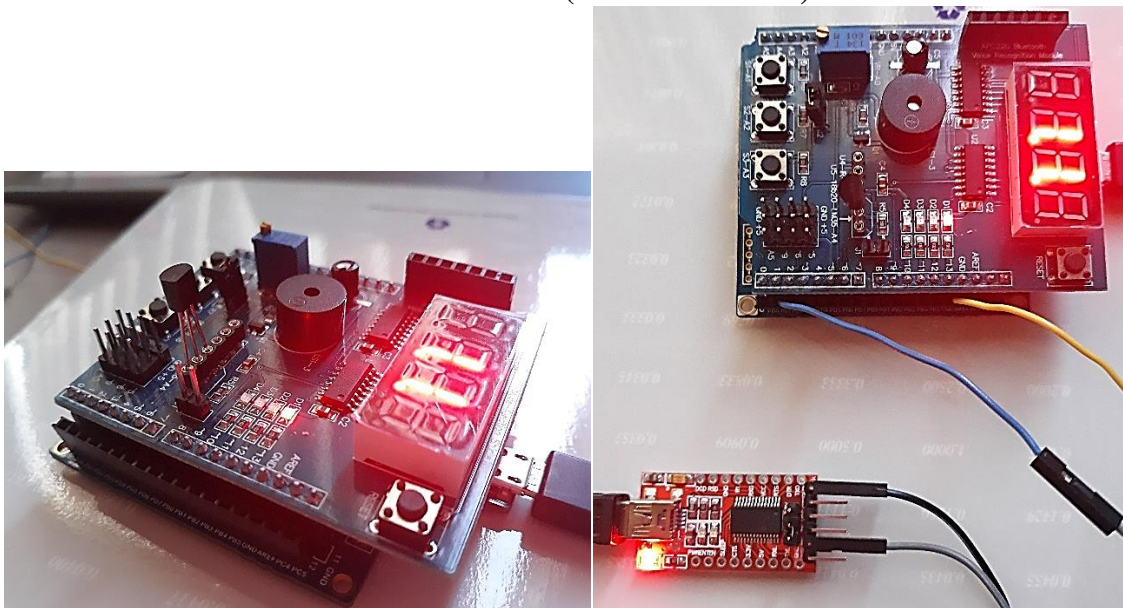
```
Fahrenheit degree: 95.000000
Celcius degree: 33.000000
```

### Serial plot





## 6. SCREENSHOT OF EACH DEMO (BOARD SETUP)



## 7. VIDEO LINKS OF EACH DEMO

<https://www.youtube.com/watch?v=6ij6xcqGbNc>

## 8. GITHUB LINK OF THIS DA

[https://github.com/MeralAbuJaser/Submission\\_da/tree/master/DA3B](https://github.com/MeralAbuJaser/Submission_da/tree/master/DA3B)

*"This assignment submission is my own, original work".*  
Meral Abu-Jaser