C9 – Analogue Input

3.1 Measuring Voltages

```
0x    0 : 0.00000V
0x   fa : 0.80566V
0x   f6 : 0.79277V
0x  2a4 : 2.17852V
0x  339 : 2.65869V
0x  336 : 2.64902V
0x  336 : 2.64902V
0x  336 : 2.64902V
0x  336 : 2.64902V
0x  336 : 2.64902V
0x  336 : 2.64902V
0x  3ff : 3.29678V
0x  3ff : 3.29678V
0x  287 : 2.08506V
0x  193 : 1.29873V
0x  1f0 : 1.59844V
0x  2e1 : 2.37510V
0x  2e1 : 2.37510V
0x  2e1 : 2.37510V
0x  2e0 : 2.37188V
```

Full range from 0x0 to 0x3ff can be seen (full 10 bit range).

```
0x 20b : 1.68545V
0x 20c : 1.68867V
0x 20b : 1.68545V
0x 20b : 1.68545V
0x 20b : 1.68545V
0x 20b : 1.68545V
0x 20b : 1.68545V
0x 20b : 1.68545V
0x 20c : 1.68867V
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0x 20c : 1.68867V
0x 20c : 1.68867V
0x 20c : 1.68867V
0x 20c : 1.68867V
0x 20b : 1.68545V
0x 20c : 1.68867V
0x 20c : 1.68867V
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0x 20c : 1.68867V
0x 20c : 1.68867V
0x 20b : 1.68545V
0x 20c : 1.68867V
0x 20c : 1.68867V
0x 20c : 1.68867V
0x 20c : 1.68867V
0x 20c : 1.68867V
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0x 20c : 1.68867V
0x 20c : 1.68867V
0x 20c : 1.68867V
```

Vmin = 1.68545V
Vmax = 1.68867V

Log 2 (3.3 / (1.68867 - 1.6854))
= 10.001

3.2 Building a Proximity Detector

```
0x 3cb : 3.12920V
0x 3db : 3.18076V
0x 3db : 3.18076V
0x 3db : 3.18076V
0x 3d2 : 3.15176V
0x  45 : 0.22236V
0x  39 : 0.18369V
0x  38 : 0.18047V
0x  37 : 0.17725V
0x  c2 : 0.62520V
0x 15f : 1.13115V
0x  39 : 0.18369V
0x  41 : 0.20947V
0x 3de : 3.19043V
0x 3db : 3.18076V
0x 3de : 3.19043V
0x 2ec : 2.41055V
0x  38 : 0.18047V
0x  38 : 0.18047V
0x  38 : 0.18047V
0x  39 : 0.18369V
0x  39 : 0.18369V
0x  38 : 0.18047V
0x  38 : 0.18047V
0x  36 : 0.17402V
0x  37 : 0.17725V
0x 3c4 : 3.10664V
0x 3dc : 3.18398V
0x 3dc : 3.18398V
0x 3db : 3.18076V
0x 3db : 3.18076V
0x 3db : 3.18076V
0x 3db : 3.18076V
```

Threshold for detect = 2.8V
2.8/3.3 * 1024 = 868 (adc value)

```
void channel_adc(uint8_t n) {
    ADMUX = n;

    ADMUX |= _BV(REFS0);            //AVCC reference
    ADMUX |= _BV(ADLAR);            //left to right in ADCH / ADCL
}
```

```
No Finger
No Finger
No Finger
No Finger
No Finger
No Finger
No Finger
Finger Detected
Finger Detected
Finger Detected
Finger Detected
Finger Detected
Finger Detected
No Finger
No Finger
No Finger
No Finger
No Finger
Finger Detected
Finger Detected
Finger Detected
No Finger
Finger Detected
Finger Detected
Finger Detected
Finger Detected
Finger Detected
Finger Detected
```

```
if(read_adc() < PROX_BOUND) {
    printf("Finger Detected\n");
    PORTB |= _BV(PB7);
}
else {
    printf("No Finger\n");
    PORTB &= ~_BV(PB7);
}
_delay_ms(200);
```

3.3 Measuring your Heart Rate

```
//only prints heartbeat when proximity is ok
if(fingerValue() < PROX_BOUND) {
    PORTB |= _BV(PB7);          //set led high

    tempHeartValue = heartValue();

    //new peak
    if((curPeak == 0) && (tempHeartValue > HEART_BOUND)) {
        curPeak = 1;


        heartPeriod = (tim * TIME_PERIOD);  //time period between heartbeats (ms)
        heartRate = 60000 / heartPeriod;                //60 / time period = BPM

        printf("Time Period: %f\t", heartPeriod);
        printf("Heart Rate: %f\n", heartRate);
        tim = 0;
    }
    else {
        tim++;
        //printf("No Peak");
    }

    //no longer peak
    if((curPeak != 0) && (tempHeartValue < HEART_BOUND)) {
        curPeak = 0;

    }
}

//no finger so led off
else {
    PORTB &= ~_BV(PB7);
}
_delay_ms(TIME_PERIOD);
```

It was hard to view the pulses on the oscilliscope since the Bitscope software only allows 100ms per division which is not enough to see multiple pulses and measure the time between them.