LAMPIRAN B
TAMPILAN OSILOSKOP OUTPUT SENSOR TCS3200
BERSERTA PERHITUNGAN FREKUENSI

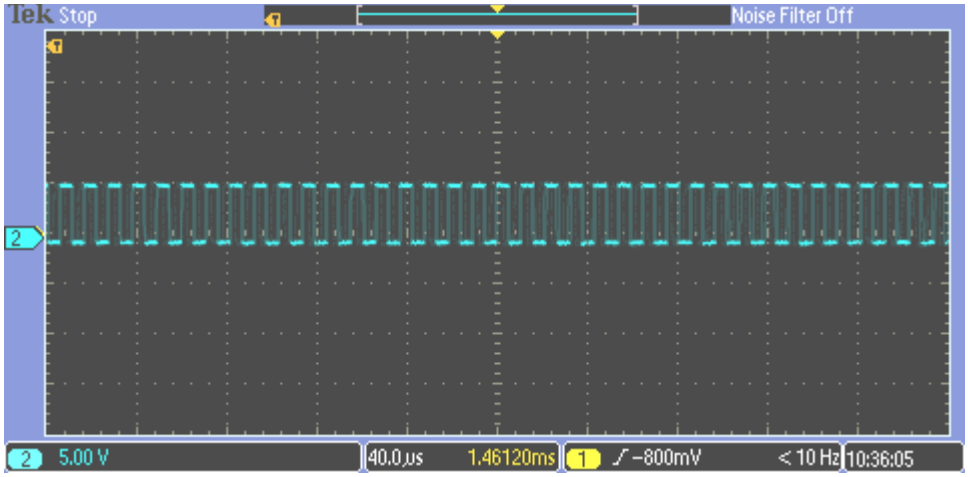
A. Diketahui

- V/div = 5 V_{dc}
- T/div = 40µs
- Satu div/kotak diosiloskop terbagi menjadi 5 titik, jadi untuk menentukan nilai periode (T) per satu titik di osiloskop untuk satu kotak harus kita bagi 5 dan hasilnya adalah $\frac{40\mu s}{5} =$ 8µs (8x10^{-6} s). Ini dihitung mengingat untuk satu gelombang periode di osiloskop ada yang tidak mencapai nilai satu kotak dan juga ada yang melebihi dari satu kotak. T/satu titik osiloskop = 8µs (8x10^{-6} s).
- Rumus mencari frekuensi; $f = \frac{1}{T}$

  Ket: f = frekuensi (Hz)

  T = Periode (s)

A1. Nilai RGB Warna Merah



Gambar A1.1 Hasil Pengukuran Frekuensi Nilai *Red*

- Frekuensi nilai *Red*

  T_{red} = banyak titik per satu gelombang × T per satu titik diosiloskop

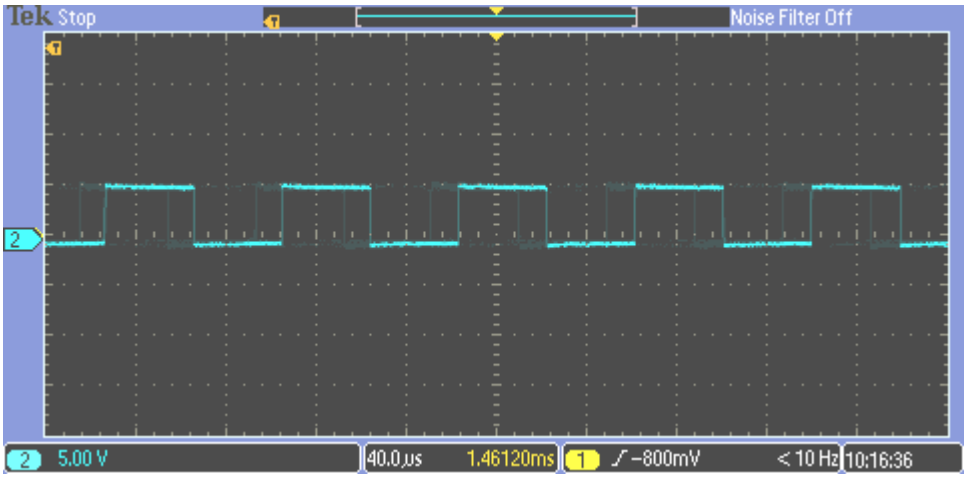
  $= 1{,}5 \times (8 \times 10^{-6})$

  $= 12 \times 10^{-6} s$

$$f_{red} = \frac{1}{T_{red}}$$

$$= \frac{1}{12 \times 10^{-6}}$$

$$= 83{,}3 \times 10^{3} Hz$$



Gambar A1.2 Hasil Pengukuran Frekuensi Nilai *Green*

- Frekuensi nilai *Green*

  T_{greeen} = banyak titik per satu gelombang × T per satu titik diosiloskop

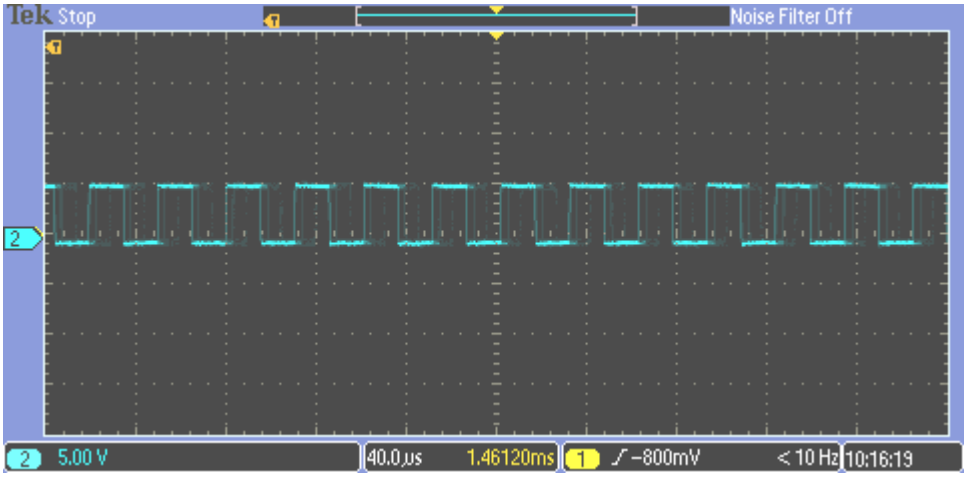
  $= 5 \times (8 \times 10^{-6})$

  $= 40 \times 10^{-6} s$

$$f_{green} = \frac{1}{T_{green}}$$

$$= \frac{1}{40 \times 10^{-6}}$$

$$= 25 \times 10^{3} Hz$$



Gambar A1.3 Hasil Pengukuran Frekuensi Nilai *Blue*

- Frekuensi nilai *blue*

  T_{blue} = banyak titik per satu gelombang × T per satu titik diosiloskop

  $= 4 \times (8 \times 10^{-6})$

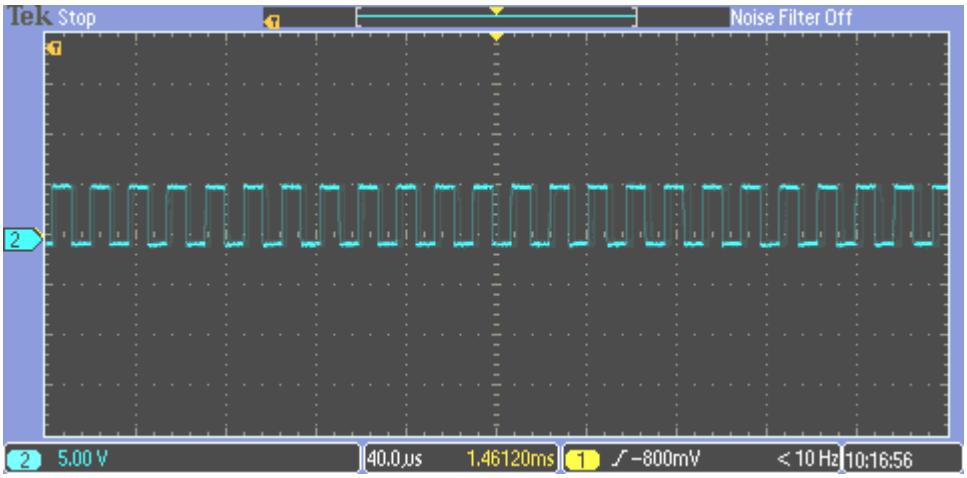
  $= 32 \times 10^{-6} s$

$$f_{blue} = \frac{1}{T_{blue}}$$

$$= \frac{1}{32 \times 10^{-6}}$$

$$= 31{,}2 \times 10^{3} Hz$$

A2. Nilai RGB Warna Kuning



Gambar A2.1 Hasil Pengukuran Frekuensi Nilai *Red*

- Frekuensi nilai *red*

  T_{red} = banyak titik per satu gelombang × T per satu titik diosiloskop

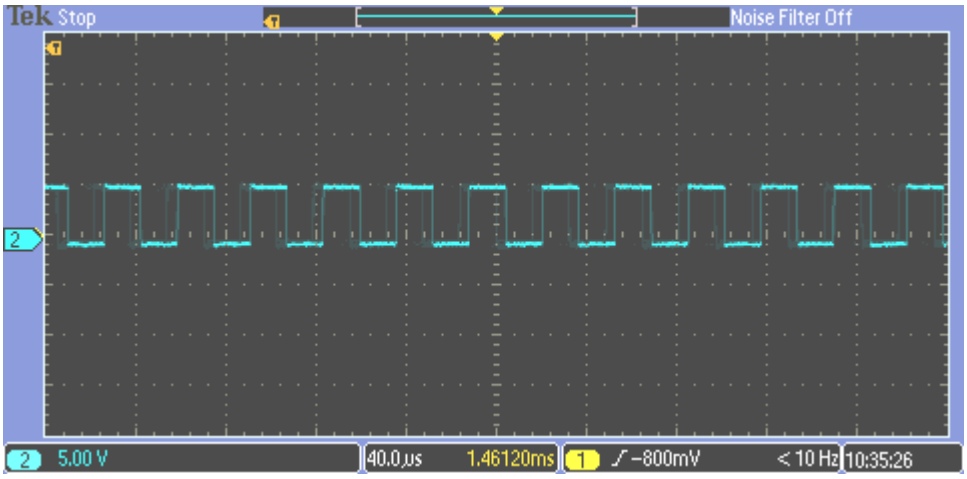
  $= 2 \times (8 \times 10^{-6})$

  $= 16 \times 10^{-6} s$

$$f_{red} = \frac{1}{T_{red}}$$

$$= \frac{1}{16 \times 10^{-6}}$$

$$= 62{,}5 \times 10^{3} Hz$$



Gambar A2.2 Hasil Pengukuran Frekuensi Nilai *Green*

- Frekuensi nilai *Green*

  T_{greeen} = banyak titik per satu gelombang × T per satu titik diosiloskop

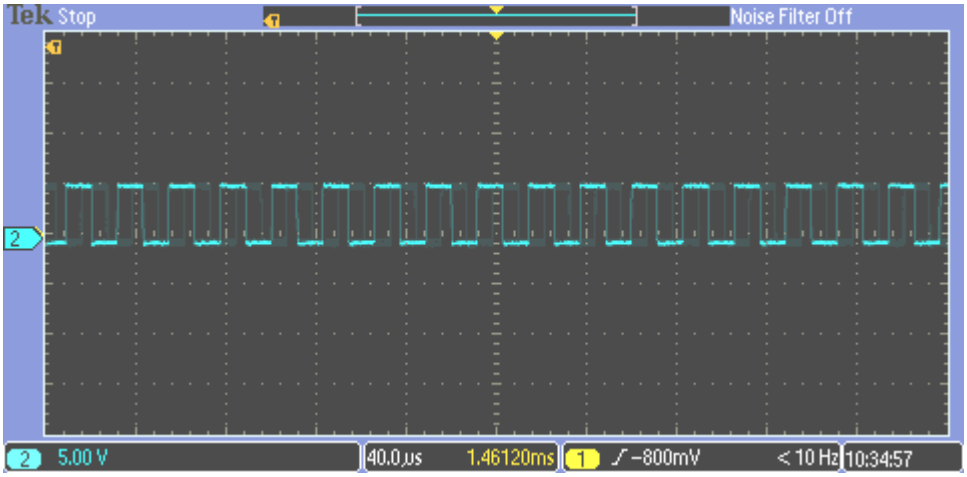
  $= 4 \times (8 \times 10^{-6})$

  $= 32 \times 10^{-6} s$

$$f_{green} = \frac{1}{T_{green}}$$

$$= \frac{1}{32 \times 10^{-6}}$$

$$= 31{,}2 \times 10^{3} Hz$$



Gambar A2.3 Hasil Pengukuran Frekuensi Nilai *Blue*

- Frekuensi nilai *blue*

  T_{blue} = banyak titik per satu gelombang × T per satu titik diosiloskop

  $= 3 \times (8 \times 10^{-6})$

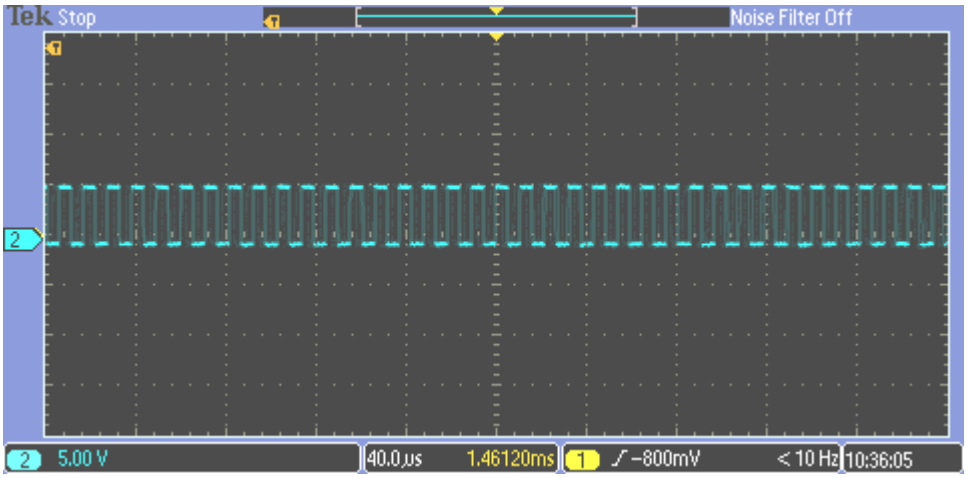
  $= 24 \times 10^{-6} s$

$$f_{blue} = \frac{1}{T_{blue}}$$

$$= \frac{1}{24 \times 10^{-6}}$$

$$= 41{,}6 \times 10^{3} Hz$$

A3. Nilai RGB Warna Jingga



Gambar A3.1 Hasil Pengukuran Frekuensi Nilai *Red*

- Frekuensi nilai *Red*

  T_{red} = banyak titik per satu gelombang × T per satu titik diosiloskop

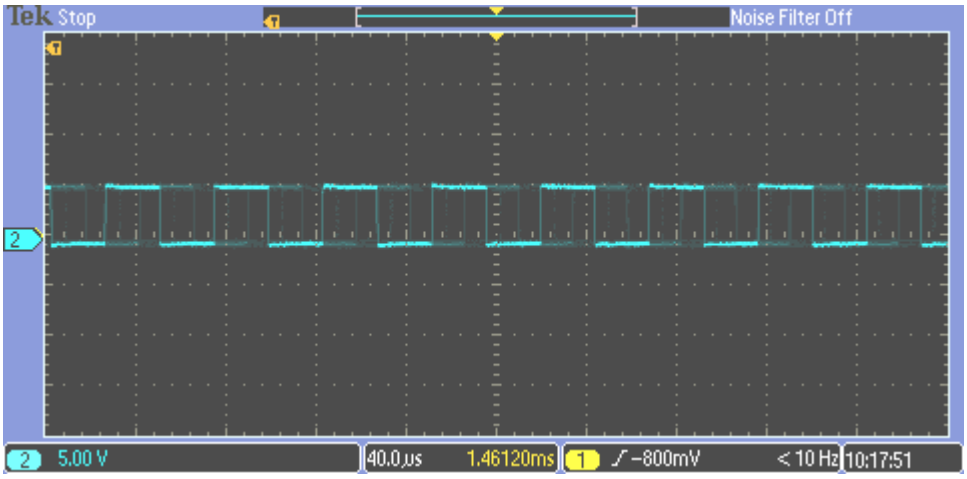
  $= 1{,}5 \times (8 \times 10^{-6})$

  $= 12 \times 10^{-6} s$

$$f_{red} = \frac{1}{T_{red}}$$

$$= \frac{1}{12 \times 10^{-6}}$$

$$= 83{,}3 \times 10^{3} Hz$$



Gambar A3.2 Hasil Pengukuran Frekuensi Nilai *Green*

- Frekuensi nilai *Green*

  T_{greeen} = banyak titik per satu gelombang × T per satu titik diosiloskop

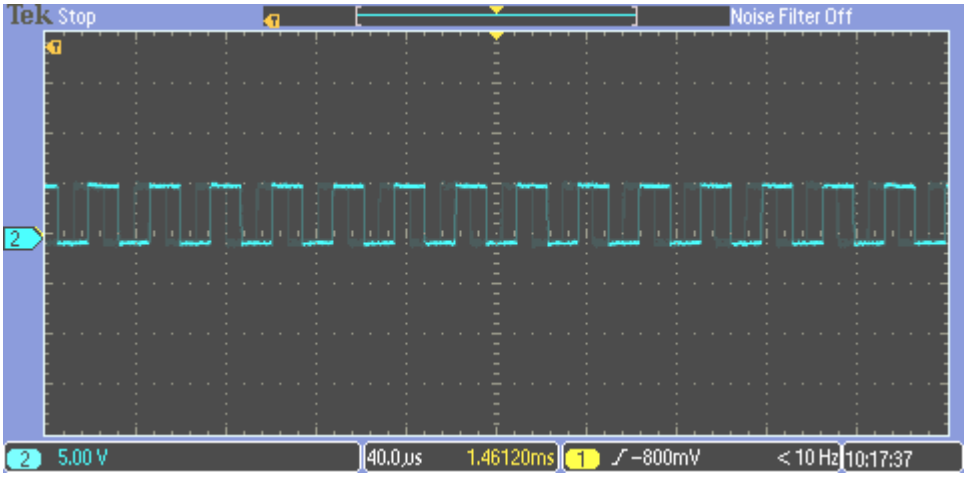
  $= 6 \times (8 \times 10^{-6})$

  $= 48 \times 10^{-6} s$

$$f_{green} = \frac{1}{T_{green}}$$

$$= \frac{1}{48 \times 10^{-6}}$$

$$= 20{,}8 \times 10^{3} Hz$$



Gambar A3.3 Hasil Pengukuran Frekuensi Nilai *Blue*

- Frekuensi nilai *blue*

  T_{blue} = banyak titik per satu gelombang × T per satu titik diosiloskop

  $= 3{,}5 \times (8 \times 10^{-6})$

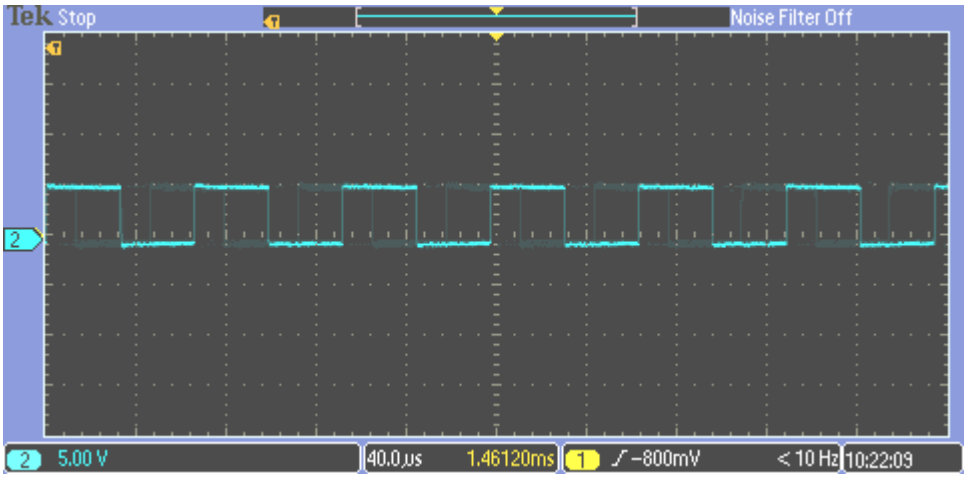
  $= 28 \times 10^{-6} s$

$$f_{blue} = \frac{1}{T_{blue}}$$

$$= \frac{1}{28 \times 10^{-6}}$$

$$= 35{,}7 \times 10^{3} Hz$$

A4. Nilai RGB Warna Hijau



Gambar A4.1 Hasil Pengukuran Frekuensi Nilai *Red*

- Frekuensi nilai *Red*

  T_{red} = banyak titik per satu gelombang × T per satu titik diosiloskop

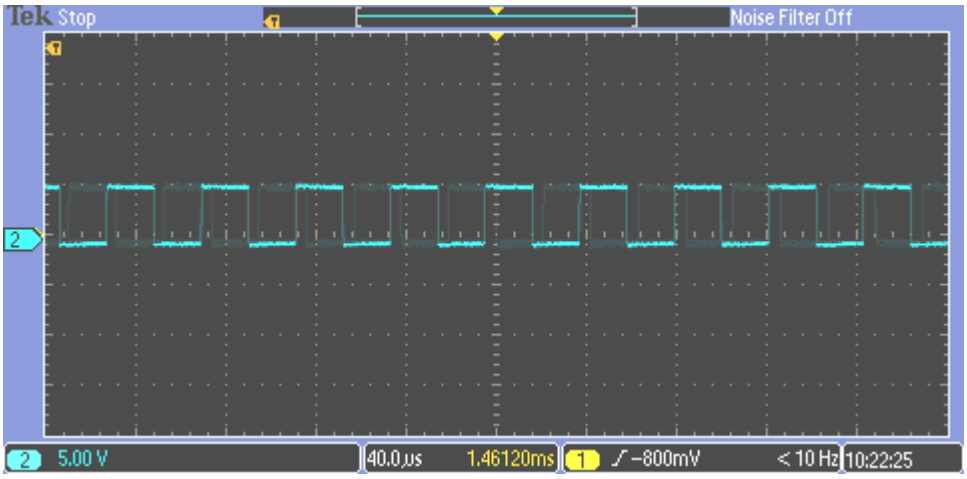
  $= 5 \times (8 \times 10^{-6})$

  $= 40 \times 10^{-6} s$

$$f_{Red} = \frac{1}{T_{red}}$$

$$= \frac{1}{40 \times 10^{-6}}$$

$$= 25 \times 10^{3} Hz$$



Gambar A4.2 Hasil Pengukuran Frekuensi Nilai *Green*

- Frekuensi nilai *Green*

  T_{greeen} = banyak titik per satu gelombang × T per satu titik diosiloskop

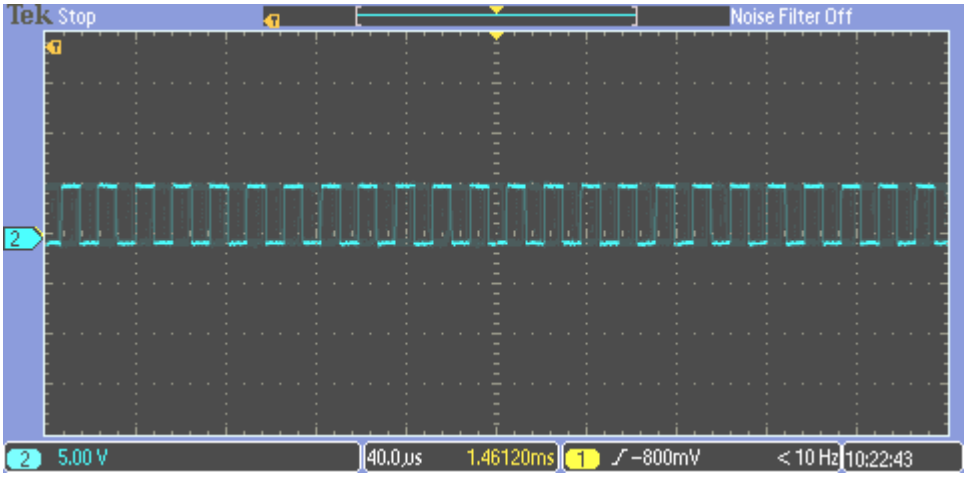
  $= 2 \times (8 \times 10^{-6})$

  $= 16 \times 10^{-6} s$

$$f_{green} = \frac{1}{T_{green}}$$

$$= \frac{1}{16 \times 10^{-6}}$$

$$= 62{,}5 \times 10^{3} Hz$$



Gambar A4.3 Hasil Pengukuran Frekuensi Nilai *Blue*

- Frekuensi nilai *Blue*

  T_{blue} = banyak titik per satu gelombang × T per satu titik diosiloskop

  $= 8 \times (8 \times 10^{-6})$

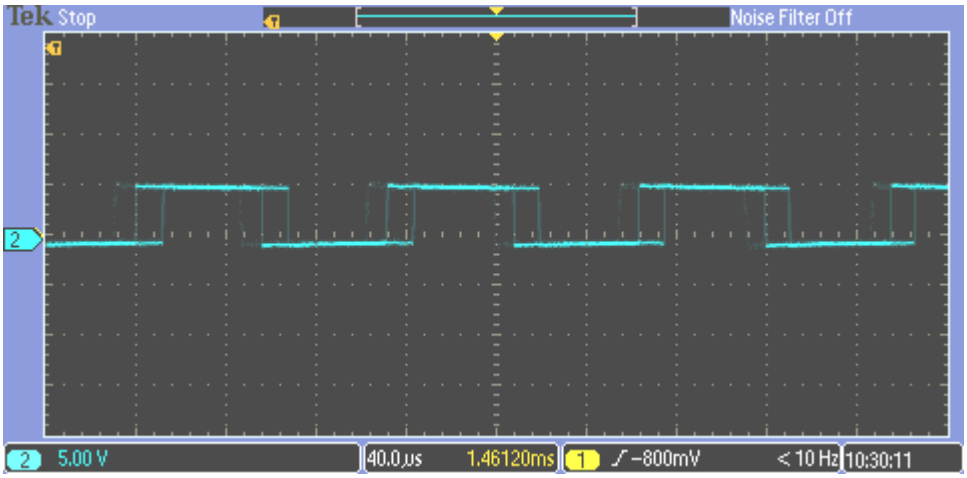
  $= 64 \times 10^{-6} s$

$$f_{Blue} = \frac{1}{T_{blue}}$$

$$= \frac{1}{64 \times 10^{-6}}$$

$$= 15{,}6 \times 10^{3} Hz$$

A5. Nilai RGB Warna Biru



Gambar A5.1 Hasil Pengukuran Frekuensi Nilai *Red*

- Frekuensi nilai *Red*

  T_{red} = banyak titik per satu gelombang × T per satu titik diosiloskop

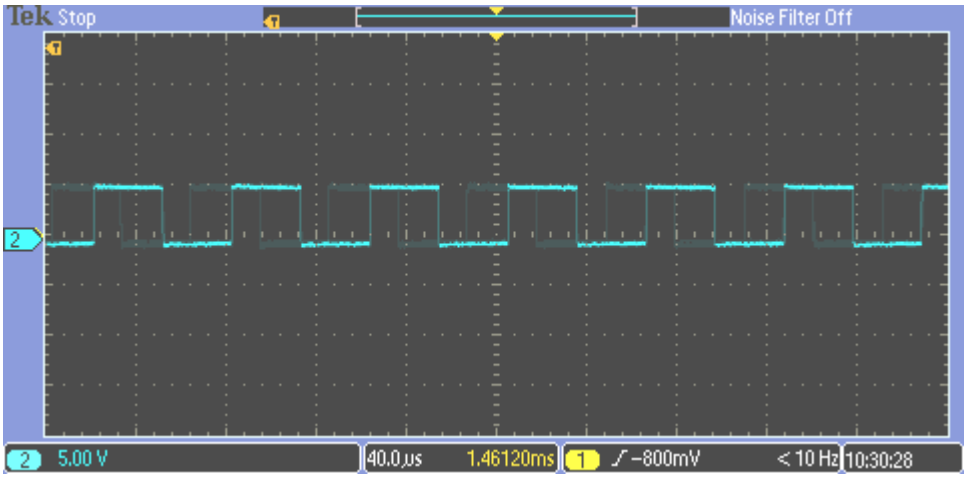
  $= 14 \times (8 \times 10^{-6})$

  $= 112 \times 10^{-6} s$

$$f_{Red} = \frac{1}{T_{red}}$$

$$= \frac{1}{112 \times 10^{-6}}$$

$$= 8{,}9 \times 10^{3} Hz$$



Gambar A5.2 Hasil Pengukuran Frekuensi Nilai *Green*

- Frekuensi nilai *Green*

  T_{greeen} = banyak titik per satu gelombang × T per satu titik diosiloskop

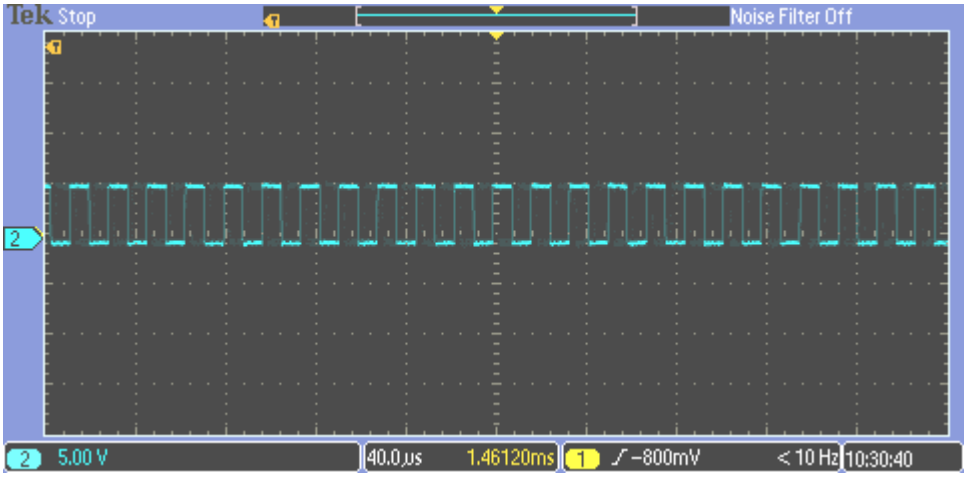
  $= 8 \times (8 \times 10^{-6})$

  $= 64 \times 10^{-6} s$

$$f_{green} = \frac{1}{T_{green}}$$

$$= \frac{1}{64 \times 10^{-6}}$$

$$= 15{,}6 \times 10^{3} Hz$$



Gambar A5.3 Hasil Pengukuran Frekuensi Nilai *Blue*

- Frekuensi nilai *Blue*

  T_{blue} = banyak titik per satu gelombang × T per satu titik diosiloskop

  $= 2 \times (8 \times 10^{-6})$

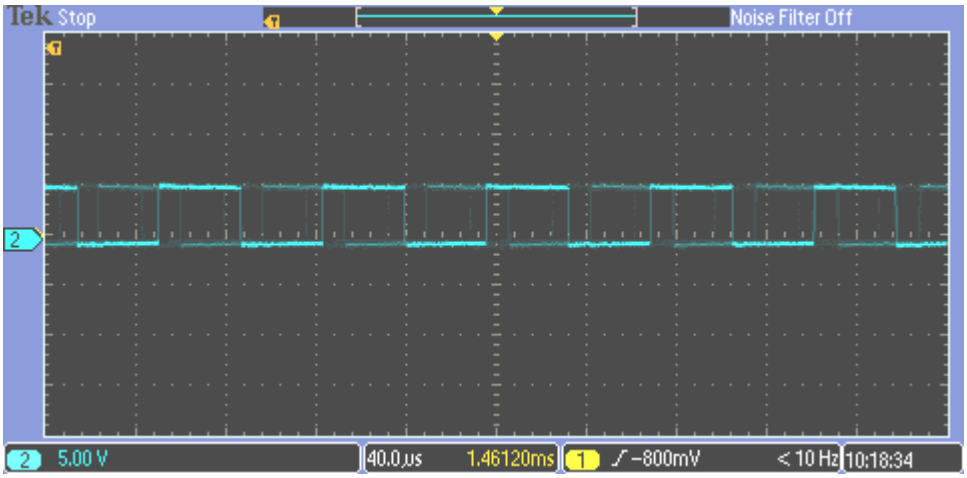
  $= 16 \times 10^{-6} s$

$$f_{Blue} = \frac{1}{T_{blue}}$$

$$= \frac{1}{16 \times 10^{-6}}$$

$$= 62{,}5 \times 10^{3} Hz$$

A6. Nilai RGB Warna Cokelat



Gambar A6.1 Hasil Pengukuran Frekuensi Nilai *Red*

- Frekuensi nilai *Red*

  T_{red} = banyak titik per satu gelombang × T per satu titik diosiloskop

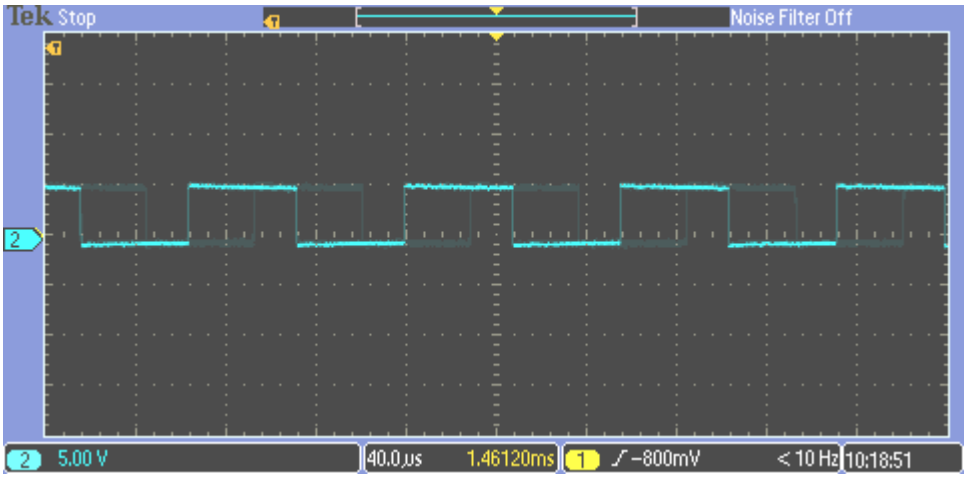
  $= 9 \times (8 \times 10^{-6})$

  $= 72 \times 10^{-6} s$

$$f_{Red} = \frac{1}{T_{red}}$$

$$= \frac{1}{72 \times 10^{-6}}$$

$$= 13{,}8 \times 10^{3} Hz$$



Gambar A6.2 Hasil Pengukuran Frekuensi Nilai *Green*

- Frekuensi nilai *Green*

  T_{greeen} = banyak titik per satu gelombang × T per satu titik diosiloskop

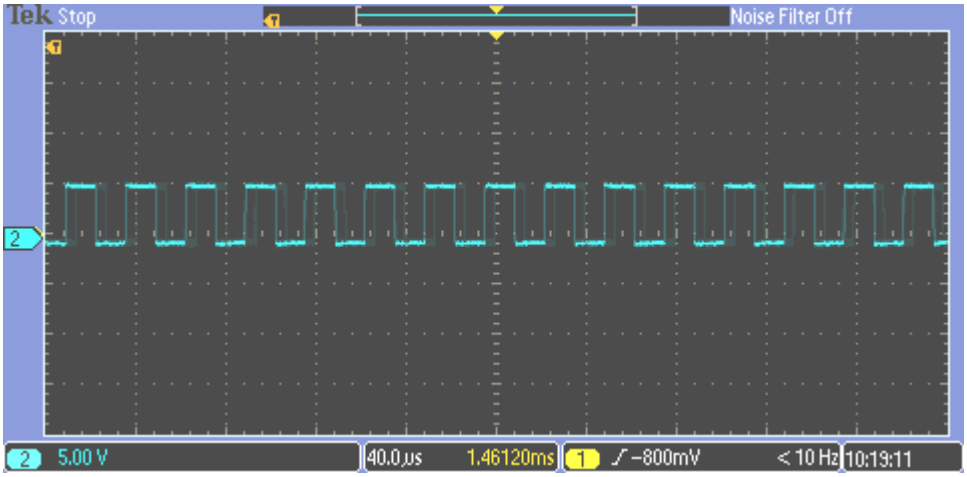
  $= 12 \times (8 \times 10^{-6})$

  $= 96 \times 10^{-6} s$

$$f_{green} = \frac{1}{T_{green}}$$

$$= \frac{1}{96 \times 10^{-6}}$$

$$= 10{,}4 \times 10^{3} Hz$$



Gambar A6.3 Hasil Pengukuran Frekuensi Nilai *Blue*

- Frekuensi nilai *Blue*

  T_{blue} = banyak titik per satu gelombang × T per satu titik diosiloskop

  $= 3{,}5 \times (8 \times 10^{-6})$

  $= 28 \times 10^{-6} s$

$$f_{Blue} = \frac{1}{T_{blue}}$$

$$= \frac{1}{28 \times 10^{-6}}$$

$$= 35{,}7 \times 10^{3} Hz$$

LAMPIRAN C
CODING MIKROKONTROLER ARDUINO UNO

```
#include<Wire.h>
#include<LCD.h>
#include<LiquidCrystal_I2C.h>
#include <Servo.h>

//conveyor
#define in1 2
#define in2 3
#define conveyor 4
#define tombol 8

//sensorwarna
#define S0 9
#define S1 10
#define S2 11
#define S3 12
#define sensorOut 13

//kotakwarna
#define merah 0
#define kuning 1
#define jingga 2
#define hijau 3
#define coklat 4
#define biru 5

//LCD
#define I2C_ADDR 0x27
#define BACKLIGHT_PIN 3
#define En_pin 2
#define Rw_pin 1
#define Rs_pin 0
#define D4_pin 4
#define D5_pin 5
#define D6_pin 6
#define D7_pin 7

Servo myservo;
```

```
LiquidCrystal_I2C lcd(I2C_ADDR, En_pin, Rw_pin, Rs_pin, D4_pin,
D5_pin, D6_pin, D7_pin);

int pos = 0;

int red = 0;
int green = 0;
int blue = 0;

int posisi_sebelumnya = 0;
int posisi_tujuan = 0;
const int stepsPerRevolution = 200;

int stepCount = 0 ;
float hasil_kali = 0;
int satu_kotak = -333;
const int stepPin = 5;
const int dirPin = 6;

int jkuning = 0 ;
int jmerah = 0 ;
int jjingga = 0 ;
int jhijau = 0 ;
int jcoklat = 0 ;
int jbiru = 0 ;

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  myservo.attach(7);

    pinMode(S0,OUTPUT);
    pinMode(S1,OUTPUT);
    pinMode(S2,OUTPUT);
    pinMode(S3,OUTPUT);
    pinMode(sensorOut,INPUT);

//setting frequency-scaling to 20%
digitalWrite(S0,HIGH);
digitalWrite(S1,HIGH);

  lcd.begin(20, 4);
  lcd.setBacklight(1);
```

```
  lcd.home();
  lcd.print("  ADECA dan PENNY  ");

  myservo.write(130);
  delay(500);
  pinMode(stepPin, OUTPUT);
  pinMode(dirPin, OUTPUT);

  pinMode(tombol, INPUT_PULLUP);
  while (digitalRead(tombol)) {
    gerak_stepper(1);
    //Serial.println(digitalRead(tombol));
  }
}

void loop() {
  //red colour
  digitalWrite(S2, LOW);
  digitalWrite(S3, LOW);
  //reading the output frequency
  red = pulseIn(sensorOut, LOW);
  Serial.print("R= ");
  Serial.print(red);
  Serial.print("  ");
  delay(100);

  //green colour
  digitalWrite(S2, HIGH);
  digitalWrite(S3, HIGH);
  //reading the output frequency
  green = pulseIn(sensorOut, LOW);
  Serial.print("G= ");
  Serial.print(green);
  Serial.print("  ");
  delay(100);

  //blue colour
  digitalWrite(S2, LOW);
  digitalWrite(S3, HIGH);
  //reading the output frequency
  blue = pulseIn(sensorOut, LOW);

  Serial.print("B= ");
```

```
  Serial.print(blue);
  Serial.print("  ");
  delay(100);
  Serial.println();

  //MERAH
  if (red >= 14 && red <= 20 && green >= 44 && green <= 53) {
    delay(2000);
      if (red >= 14 && red <= 20 && green >= 44 && green <= 53) {
      posisi_tujuan = merah;
      Serial.print("posisi                sebelum                =
");Serial.println(posisi_sebelumnya);
      Serial.print("posisi                 tujuan                =
");Serial.println(posisi_tujuan);

      int  putaran  =  (posisi_tujuan    -  posisi_sebelumnya)  *
satu_kotak;
      Serial.println(putaran);
      gerak_stepper((int)putaran);
      jmerah+=1;
      putar();
      myservo.write(45);
      delay (3000);
      myservo.write(130);
      delay (3000);
      berhenti();
      posisi_sebelumnya = posisi_tujuan  ;
    } else {
      berhenti();
    }
  } else {
    berhenti();
  }

  //BIRU
   if (red >= 45 && red <= 53 && blue >= 11 && blue <= 18) {
    delay(2000);
     if (red >= 45 && red <= 53 && blue >= 11 && blue <= 18) {
      posisi_tujuan = biru;
      float  putaran  =  (posisi_tujuan    -  posisi_sebelumnya)  *
satu_kotak;
      jbiru+=1;
      gerak_stepper(putaran);
```

```
      Serial.println(putaran);

      putar();
      myservo.write(45);
      delay (3000);
      myservo.write(130);
      delay (3000);
      berhenti();
      posisi_sebelumnya = posisi_tujuan  ;

    } else {
      berhenti();
    }
  } else {
    berhenti();
  }

  //KUNING
    if (red >= 10 && red <= 13 && green >= 14 && green <= 18) {
    delay(2000);
      if (red >= 10 && red <= 13 && green >= 14 && green <= 18) {
      posisi_tujuan = kuning;
      float  putaran  =  (posisi_tujuan    -  posisi_sebelumnya)  *
satu_kotak;
      Serial.println(putaran);
      gerak_stepper(putaran);
      jkuning+=1;
      putar();
      myservo.write(45);
      delay (3000);
      myservo.write(130);
      delay (3000);
      berhenti();
            posisi_sebelumnya = posisi_tujuan  ;

    } else {
      berhenti();
    }
  } else {
    berhenti();
  }

  //HIJAU
```

```
    if (red >= 40 && red <= 46 && green >= 25 && green <= 30) {
    delay(2000);
     if (red >= 40 && red <= 46 && green >= 25 && green <= 30) {
      posisi_tujuan = hijau;
      float  putaran  =  (posisi_tujuan    -  posisi_sebelumnya)  *
satu_kotak;
      Serial.println(putaran);
    gerak_stepper(putaran);
      jhijau+=1;
      putar();
      myservo.write(45);
      delay (3000);
      myservo.write(130);
      delay (3000);
      berhenti();
            posisi_sebelumnya = posisi_tujuan  ;

    } else {
      berhenti();
    }
  } else {
    berhenti();
  }

  //JINGGA
   if (green >= 20 && green <= 24 && blue >= 27 && blue <= 30){
    delay(2000);
      if (green >= 20 && green <= 24 && blue >= 27 && blue <=
30){
      posisi_tujuan = jingga;
      float  putaran  =  (posisi_tujuan    -  posisi_sebelumnya)  *
satu_kotak;
      jjingga+=1;
      gerak_stepper(putaran);
      Serial.println(putaran);

      putar();
      myservo.write(45);
      delay (3000);
      myservo.write(130);
      delay (3000);
      berhenti();
            posisi_sebelumnya = posisi_tujuan  ;
```

```
    } else {
      berhenti();
    }
  } else {
    berhenti();
  }
  //COKLAT
    if (red >= 38 && red <= 46 && green >= 55 && green <= 64){
    delay(2000);
      if (red >= 38 && red <= 46 && green >= 55 && green <= 64){
      posisi_tujuan = coklat;
      float  putaran  =  (posisi_tujuan    -  posisi_sebelumnya)  *
satu_kotak;
      jcoklat+=1;
      gerak_stepper(putaran);
      Serial.println(putaran);

      putar();
      myservo.write(45);
      delay (3000);
      myservo.write(130);
      delay (3000);
      berhenti();
            posisi_sebelumnya = posisi_tujuan  ;

    } else {
      berhenti();
    }
  } else {
    berhenti();
  }

  lcd.setCursor(0,0);
  lcd.print("Deteksi Warna : ");lcd.print(" ");lcd.print("  ");
  lcd.setCursor(0,1);
  lcd.print("Merah:");lcd.print(jmerah);lcd.print("  ");
  lcd.setCursor(9,1);
  lcd.print("Kuning:");lcd.print(jkuning);lcd.print("  ");
  lcd.setCursor(0,2);
  lcd.print("Jingga:");lcd.print(jjingga);lcd.print("  ");
  lcd.setCursor(9,2);
  lcd.print("Hijau:");lcd.print(jhijau);lcd.print("  ");
```

```
  lcd.setCursor(0,3);
  lcd.print("Coklat:");lcd.print(jcoklat);lcd.print("  ");
  lcd.setCursor(9,3);
  lcd.print("Biru:");lcd.print(jbiru);lcd.print("  ");
}

int hitung_step(float jumlah_putar) {
  float hasil = 0 ;
  hasil = 2048 * jumlah_putar;

  return (int)hasil;
}

void gerak_stepper(int jumlah_putar) {
  //Serial.print("Jumlah = ");Serial.print(jumlah_putar);

  if (jumlah_putar < 0 ) {
    digitalWrite(dirPin, HIGH); // Enables the motor to move in a
particular direction
  } else {
    digitalWrite(dirPin, LOW); // Enables the motor to move in a
particular direction
  }
  jumlah_putar = abs(jumlah_putar);
  for (int x = 0; x < jumlah_putar ; x++) {

    digitalWrite(stepPin, HIGH);
    delayMicroseconds(4000);
    digitalWrite(stepPin, LOW);
    delayMicroseconds(4000);
  }
}

void putar () {
  digitalWrite(in1, 1);
  digitalWrite(in2, 0);
  analogWrite(conveyor, 200);
}

void berhenti () {
  digitalWrite(in1, 1);
  digitalWrite(in2, 1);
}
```