

LAMPIRAN

LAMPIRAN A

Listing Program Arduino

Berikut ini adalah listing program yang telah dibuat untuk Arduino Uno

```
#include <TimerOne.h>

#include "EmonLib.h"

EnergyMonitor emon1;

EnergyMonitor emon2;

EnergyMonitor emon3;

#include <LiquidCrystal.h>

const int rs = 8, en = 9, d4 = 10, d5 = 11, d6 = 12, d7 = 13;

LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

volatile int i=0,j=0,k=0;

volatile boolean zero_cross=0;

volatile boolean zero_cross2=0;

volatile boolean zero_cross3=0;

unsigned int set_daya=15;

int AC_pin = 0;

int dim2 = 0;

int dim = 0;

int dim3 = 0;

int pas = 8;

int freqStep = 75;

#define beban1 3
```

```
#define beban2 4

#define beban3 5

#define sw1 6

#define sw2 7

void setup()

{

    lcd.begin(16, 2);

    lcd.print("FANSHURI");

    delay(5000);

    pinMode(sw1, INPUT_PULLUP);

    pinMode(sw2, INPUT_PULLUP);

    pinMode(beban1, OUTPUT);

    pinMode(beban2, OUTPUT);

    pinMode(beban3, OUTPUT);

    setting();

    digitalWrite(beban1, HIGH);

    digitalWrite(beban2, HIGH);

    digitalWrite(beban3, HIGH);

    attachInterrupt(0, zero_cross_detect, RISING);

    Timer1.initialize(freqStep);

    Timer1.attachInterrupt(dim_check, freqStep);

    emon1.voltage(0, 320, 1.7);
```

```
    emon1.current(3, 11.1);

    emon2.voltage(1, 320, 1.7);

    emon2.current(4, 11.1);

    emon3.voltage(2, 320, 1.7);

    emon3.current(5, 11.1);

}

void zero_cross_detect() {

    zero_cross = true;

    zero_cross2 = true;

    zero_cross3 = true;

    i=0;

    j=0;

    k=0;

    digitalWrite(beban1, LOW);

    digitalWrite(beban2, LOW);

    digitalWrite(beban3, LOW);

}

void dim_check() {

    if(zero_cross == true) {

        if(i>=dim) {

            digitalWrite(beban1, HIGH);

            i=0;

        }

    }

}
```

```
        zero_cross=false;

    }

    else {

        i++;    }

    }

if(zero_cross2 == true) {

    if(j>=dim2) {

        digitalWrite(beban2, HIGH);

        j=0;

        zero_cross2=false;

    }

    else {

        j++;

    }

}

if(zero_cross3 == true) {

    if(k>=dim3) {

        digitalWrite(beban3, HIGH);

        k=0;

        zero_cross3=false;

    }

    else {

        k++;

    }

}
```

```
    }  
}  
  
void loop()  
{  
  
  emon1.calcVI(20,2000);  
  
  wavelengths (crossings), time-out  
  
  emon2.calcVI(20,2000);  
  
  wavelengths (crossings), time-out  
  
  emon3.calcVI(20,2000);  
  
  wavelengths (crossings), time-out  
  
  
  float realPower1      = emon1.realPower;  
  
  float apparentPower1  = emon1.apparentPower;  
  
  float powerFactor1    = emon1.powerFactor;  
  
  float supplyVoltage1  = emon1.Vrms;  
  
  float Irms1           = emon1.Irms;  
  
  float realPower2      = emon2.realPower;  
  
  float apparentPower2  = emon2.apparentPower;  
  
  float powerFactor2    = emon2.powerFactor;  
  
  float supplyVoltage2  = emon2.Vrms;  
  
  float Irms2           = emon2.Irms;  
  
  float realPower3      = emon3.realPower;  
  
  float apparentPower3  = emon3.apparentPower;
```

```

float powerFactor3      = emon3.powerFactor;

float supplyVoltage3    = emon3.Vrms;

float Irms3             = emon3.Irms;

lcd.setCursor(0,0);lcd.print(" ");

if (supplyVoltage1<10){lcd.print("  ");}

else if (supplyVoltage1>9&&supplyVoltage1<100){lcd.print("  ");}

else if (supplyVoltage1>99&&supplyVoltage1<1000){lcd.print("  ");}

lcd.print(supplyVoltage1,0);lcd.print(" ");

if (supplyVoltage2<10){lcd.print("  ");}

else if (supplyVoltage2>9&&supplyVoltage2<100){lcd.print("  ");}

else if (supplyVoltage2>99&&supplyVoltage2<1000){lcd.print("  ");}

lcd.print(supplyVoltage2,0);lcd.print(" ");

if (supplyVoltage3<10){lcd.print("  ");}

else if (supplyVoltage3>9&&supplyVoltage3<100){lcd.print("  ");}

else if (supplyVoltage3>99&&supplyVoltage3<1000){lcd.print("  ");}

lcd.print(supplyVoltage3,0);lcd.print(" ");

lcd.setCursor(0,1);lcd.print(" ");

lcd.print(Irms1,2);lcd.print(" ");

lcd.print(Irms2,2);lcd.print(" ");

lcd.print(Irms3,2);lcd.print(" ");

if (apparentPower1>set_daya){dim++;if(dim>125){dim=125;}}

else if (apparentPower1<set_daya){dim--;if(dim<0){dim=0;}}

if (apparentPower2>set_daya){dim2++;if(dim2>125){dim2=125;}}

else if (apparentPower2<set_daya){dim2--;if(dim2<0){dim2=0;}}

```

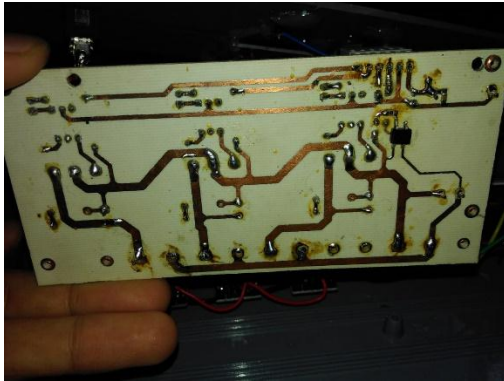
```
if (apparentPower3>set_daya) {dim3++;if (dim3>125) {dim3=125;}}
else if (apparentPower3<set_daya) {dim3--;if (dim3<0) {dim3=0;}}
}

char buff[16];

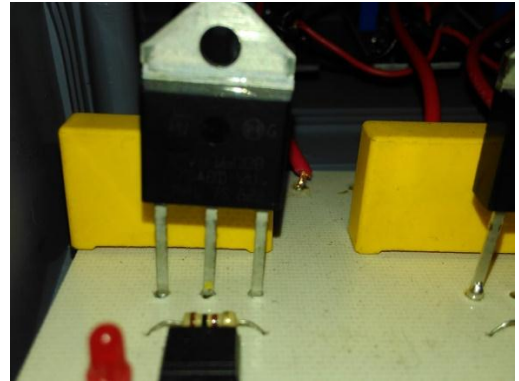
void setting(){
    while(digitalRead(sw2)==1){
        lcd.clear();
        if(digitalRead(sw1)==0){set_daya++;if
            (set_daya>200){set_daya=1;}}
        lcd.setCursor(0,0);
        lcd.print("PENGATURAN");
        lcd.setCursor(0,1);
        lcd.print("Daya= ");
        lcd.print(set_daya);
        delay(200);
    }
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("TERSIMPAN.....");
    delay(3000);
}
```


LAMPIRAN B

Dokumentasi Alat



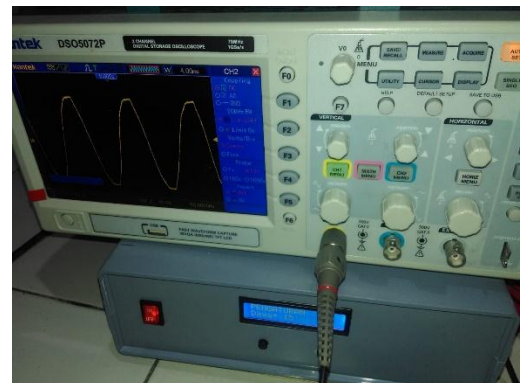
Gambar A.1 Rangkaian PCB *solid state relay* dan *zero crossing detector*



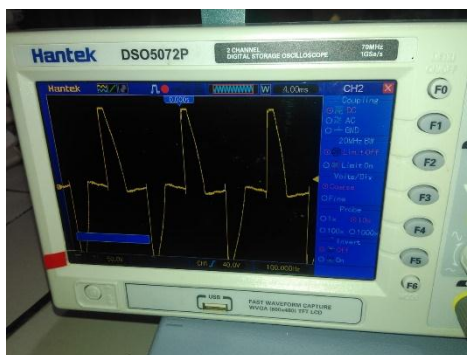
Gambar A.2 Rangkaian Triac dan MOC3021 untuk *solid state relay*



Gambar A.3 Pengujian sensor tegangan dengan Variac Slide Regulator AC



Gambar A.4 Bentuk gelombang AC beban sebelum penyesuaian daya



Gambar A.5 Bentuk gelombang AC beban setelah penyesuaian daya



Gambar A.6 Pengukuran daya lampu dengan menggunakan alat ukur standar

LAMPIRAN B

Listing Program Arduino

Berikut ini adalah listing program yang telah dibuat untuk Arduino Uno

```
#include <TimerOne.h>

#include "EmonLib.h"

EnergyMonitor emon1;

EnergyMonitor emon2;

EnergyMonitor emon3;

#include <LiquidCrystal.h>

const int rs = 8, en = 9, d4 = 10, d5 = 11, d6 = 12, d7 = 13;

LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

volatile int i=0,j=0,k=0;

volatile boolean zero_cross=0;

volatile boolean zero_cross2=0;

volatile boolean zero_cross3=0;

unsigned int set_daya=15;

int AC_pin = 0;

int dim2 = 0;

int dim = 0;

int dim3 = 0;

int pas = 8;

int freqStep = 75;

#define beban1 3
```

```
#define beban2 4

#define beban3 5

#define sw1 6

#define sw2 7

void setup()

{

  lcd.begin(16, 2);

  lcd.print("FANSHURI");

  delay(5000);

  pinMode(sw1, INPUT_PULLUP);

  pinMode(sw2, INPUT_PULLUP);

  pinMode(beban1, OUTPUT);

  pinMode(beban2, OUTPUT);

  pinMode(beban3, OUTPUT);

  setting();

  digitalWrite(beban1, HIGH);

  digitalWrite(beban2, HIGH);

  digitalWrite(beban3, HIGH);

  attachInterrupt(0, zero_cross_detect, RISING);

  Timer1.initialize(freqStep);

  Timer1.attachInterrupt(dim_check, freqStep);

  emon1.voltage(0, 320, 1.7);
```

```
    emon1.current(3, 11.1);

    emon2.voltage(1, 320, 1.7);

    emon2.current(4, 11.1);

    emon3.voltage(2, 320, 1.7);

    emon3.current(5, 11.1);

}

void zero_cross_detect() {

    zero_cross = true;

    zero_cross2 = true;

    zero_cross3 = true;

    i=0;

    j=0;

    k=0;

    digitalWrite(beban1, LOW);

    digitalWrite(beban2, LOW);

    digitalWrite(beban3, LOW);

}

void dim_check() {

    if(zero_cross == true) {

        if(i>=dim) {

            digitalWrite(beban1, HIGH);

            i=0;

        }

    }

}
```

```
        zero_cross=false;

    }

    else {

        i++;    }

    }

if(zero_cross2 == true) {

    if(j>=dim2) {

        digitalWrite(beban2, HIGH);

        j=0;

        zero_cross2=false;

    }

    else {

        j++;

    }

}

if(zero_cross3 == true) {

    if(k>=dim3) {

        digitalWrite(beban3, HIGH);

        k=0;

        zero_cross3=false;

    }

    else {

        k++;

    }

}
```

```
    }  
}  
  
void loop()  
{  
  
  emon1.calcVI(20,2000);  
  
  wavelengths (crossings), time-out  
  
  emon2.calcVI(20,2000);  
  
  wavelengths (crossings), time-out  
  
  emon3.calcVI(20,2000);  
  
  wavelengths (crossings), time-out  
  
  
  float realPower1      = emon1.realPower;  
  
  float apparentPower1  = emon1.apparentPower;  
  
  float powerFactor1    = emon1.powerFactor;  
  
  float supplyVoltage1  = emon1.Vrms;  
  
  float Irms1           = emon1.Irms;  
  
  float realPower2      = emon2.realPower;  
  
  float apparentPower2  = emon2.apparentPower;  
  
  float powerFactor2    = emon2.powerFactor;  
  
  float supplyVoltage2  = emon2.Vrms;  
  
  float Irms2           = emon2.Irms;  
  
  float realPower3      = emon3.realPower;  
  
  float apparentPower3  = emon3.apparentPower;
```

```

float powerFactor3      = emon3.powerFactor;

float supplyVoltage3    = emon3.Vrms;

float Irms3             = emon3.Irms;

lcd.setCursor(0,0);lcd.print(" ");

if (supplyVoltage1<10){lcd.print("  ");}

else if (supplyVoltage1>9&&supplyVoltage1<100){lcd.print("  ");}

else if (supplyVoltage1>99&&supplyVoltage1<1000){lcd.print("  ");}

lcd.print(supplyVoltage1,0);lcd.print(" ");

if (supplyVoltage2<10){lcd.print("  ");}

else if (supplyVoltage2>9&&supplyVoltage2<100){lcd.print("  ");}

else if (supplyVoltage2>99&&supplyVoltage2<1000){lcd.print("  ");}

lcd.print(supplyVoltage2,0);lcd.print(" ");

if (supplyVoltage3<10){lcd.print("  ");}

else if (supplyVoltage3>9&&supplyVoltage3<100){lcd.print("  ");}

else if (supplyVoltage3>99&&supplyVoltage3<1000){lcd.print("  ");}

lcd.print(supplyVoltage3,0);lcd.print(" ");

lcd.setCursor(0,1);lcd.print(" ");

lcd.print(Irms1,2);lcd.print(" ");

lcd.print(Irms2,2);lcd.print(" ");

lcd.print(Irms3,2);lcd.print(" ");

if (apparentPower1>set_daya){dim++;if(dim>125){dim=125;}}

else if (apparentPower1<set_daya){dim--;if(dim<0){dim=0;}}

if (apparentPower2>set_daya){dim2++;if(dim2>125){dim2=125;}}

else if (apparentPower2<set_daya){dim2--;if(dim2<0){dim2=0;}}

```

```
if (apparentPower3>set_daya) {dim3++;if (dim3>125) {dim3=125;}}  
else if (apparentPower3<set_daya) {dim3--;if (dim3<0) {dim3=0;}}  
}  
  
char buff[16];  
  
void setting() {  
    while(digitalRead(sw2)==1) {  
        lcd.clear();  
        if(digitalRead(sw1)==0) {set_daya++;if  
            (set_daya>200) {set_daya=1;}}  
        lcd.setCursor(0,0);  
        lcd.print("PENGATURAN");  
        lcd.setCursor(0,1);  
        lcd.print("Daya= ");  
        lcd.print(set_daya);  
        delay(200);  
    }  
    lcd.clear();  
    lcd.setCursor(0,0);  
    lcd.print("TERSIMPAN.....");  
    delay(3000);  
}
```