LAMPIRAN

1. Hasil Perhitungan BPM terhadap Modul TA dengan Doppler

a. Hasil Perhitungan BPM pada Setting 60 BPM

Nilai Rata-rata Pada Display Modul TA:

$$\overline{X} = \frac{58 + 60 + 58 + 60 + 58 + 58 + 58 + 58 + 58 + 58}{10}$$

$$\overline{\mathrm{X}} = \frac{584}{10} = 58{,}4$$

Nilai Rata-rata Pada Pembanding Modul:

$$\overline{X} = \frac{60 + 60 + 60 + 60 + 60 + 60 + 60 + 60 + 60 + 60}{10}$$

$$\overline{\mathrm{X}} = \frac{600}{10} = 60$$

Erorr (%):

$$\% = \frac{60 - 58{,}4}{60} \mathrm{x}\ 100\% = 0{,}027\ \%$$

Simpangan :

Simpangan = 60 – 58,4 = 1,6

Standar Deviasi (SD)

$$\mathrm{SD} = \sqrt{\frac{(58 - 58{,}4)^2 + (60 - 58{,}4)^2 + (58 - 58{,}4)^2 + (60 - 58{,}4)^2 + (58 - 58{,}4)^2}{10 - 1}}$$

$$\mathrm{SD} = \sqrt{\frac{(58 - 58{,}4)^2 + (58 - 58{,}4)^2 + (58 - 58{,}4)^2 + (58 - 58{,}4)^2 + (58 - 58{,}4)^2}{10 - 1}}$$

$$\mathrm{SD} = \sqrt{\frac{6{,}4}{10-1}} = 0{,}8432740427$$

Ua (Ketidakpastian):

$$Ua = \frac{0.84327404}{\sqrt{10}} = 0.2666666667$$

b. Hasil Perhitungan BPM pada Setting 90 BPM

Nilai Rata-rata Pada Display Modul TA:

$$\overline{X} = \frac{87 + 87 + 87 + 87 + 87 + 86 + 87 + 87 + 87 + 87}{10}$$

$$\overline{\mathrm{X}} = \frac{869}{10} = 86{,}9$$

Nilai Rata-rata Pada Pembanding Modul:

$$\overline{X} = \frac{89 + 89 + 89 + 89 + 89 + 89 + 89 + 89 + 89 + 89}{10}$$

$$\overline{\mathrm{X}} = \frac{890}{10} = 89$$

Erorr (%):

$$\% = \frac{90 - 86{,}9}{90} \mathrm{x}\ 100\% = 0{,}034\ \%$$

Simpangan :

Simpangan = 90 – 86,9 = 3,1

Standar Deviasi (SD)

$$\mathrm{SD} = \sqrt{\frac{(87 - 86{,}9)^2 + (87 - 86{,}9)^2 + (87 - 86{,}9)^2 + (87 - 86{,}9)^2 + (87 - 86{,}9)^2}{10 - 1}}$$

$$\mathrm{SD} = \sqrt{\frac{(86 - 86{,}9)^2 + (87 - 86{,}9)^2 + (87 - 86{,}9)^2 + (87 - 86{,}9)^2 + (87 - 86{,}9)^2}{10 - 1}}$$

$$\mathrm{SD} = \sqrt{\frac{0{,}9}{10 - 1}} = 0.316227766$$

Ua (Ketidakpastian):

$$Ua = \frac{0.316227766}{\sqrt{10}} = \ 0.099999998$$

c. Hasil Perhitungan BPM pada Setting 120 BPM

Nilai Rata-rata Pada Display Modul TA:

$$\overline{X} = \frac{116 + 116 + 116 + 116 + 117 + 117 + 117 + 117 + 116 + 116}{10}$$

$$\overline{X} = \frac{1164}{10} = 116{,}4$$

Nilai Rata-rata Pada Pembanding Modul:

$$\overline{X} = \frac{120 + 120 + 120 + 120 + 120 + 120 + 120 + 120 + 120 + 120}{10}$$

$$\overline{X} = \frac{1200}{10} = 120$$

Erorr (%):

$$\% = \frac{120 - 116{,}4}{120} \text{ x } 100\% = 0{,}030\%$$

Simpangan :

Simpangan = 120 – 116,4 = 3,6

Standar Deviasi (SD)

$$\text{SD} = \sqrt{\frac{(116 - 116{,}4)^2 + (116 - 116{,}4)^2 + (116 - 116{,}4)^2 + (116 - 116{,}4)^2 + (117 - 116{,}4)^2}{10 - 1}}$$

$$\text{SD} = \sqrt{\frac{(117 - 116{,}4)^2 + (117 - 116{,}4)^2 + (117 - 116{,}4)^2 + (116 - 116{,}4)^2 + (116 - 116{,}4)^2}{10 - 1}}$$

$$\text{SD} = \sqrt{\frac{2{,}4}{10 - 1}} = 0.5163977795$$

Ua (Ketidakpastian):

$$Ua = \frac{0.5163977795}{\sqrt{10}} = 0.1632993162$$

d. Hasil Perhitungan BPM pada Setting 150 BPM

Nilai Rata-rata Pada Display Modul TA:

$$\overline{X} = \frac{145 + 145 + 145 + 145 + 146 + 145 + 146 + 145 + 146 + 145}{10}$$

$$\overline{X} = \frac{1453}{10} = 145{,}3$$

Nilai Rata-rata Pada Pembanding Modul:

$$\overline{X} = \frac{150 + 150 + 150 + 150 + 150 + 150 + 150 + 150 + 150 + 150}{10}$$

$$\overline{X} = \frac{1500}{10} = 150$$

Erorr (%):

$$\% = \frac{150 - 145{,}3}{150} \text{x } 100\% = 0{,}031\%$$

Simpangan :

Simpangan = 150 – 145,3 = 4,7

Standar Deviasi (SD)

$$\text{SD} = \sqrt{\frac{(145-145{,}3)^2 + (145-145{,}3)^2 + (145-145{,}3)^2 + (145-145{,}3)^2 + (146-145{,}3)^2}{10-1}}$$

$$\text{SD} = \sqrt{\frac{(145-145{,}3)^2 + (146-145{,}3)^2 + (145-145{,}3)^2 + (146-145{,}3)^2 + (145-145{,}3)^2}{10-1}}$$

$$\text{SD} = \sqrt{\frac{2{,}1}{10-1}} = 0.4830458915$$

Ua (Ketidakpastian):

$$Ua = \frac{0.4830458915}{\sqrt{10}} = 0.1528831327$$

e. Hasil Perhitungan BPM pada Setting 180 BPM

Nilai Rata-rata Pada Display Modul TA:

$$\overline{X} = \frac{174 + 174 + 174 + 174 + 174 + 175 + 175 + 175 + 175 + 175}{10}$$

$$\overline{X} = \frac{1745}{10} = 174{,}5$$

Nilai Rata-rata Pada Pembanding Modul:

$$\overline{X} = \frac{180 + 180 + 180 + 180 + 180 + 180 + 180 + 180 + 180 + 180}{10}$$

$$\overline{X} = \frac{1800}{10} = 180$$

Erorr (%):

$$\% = \frac{180 - 174{,}5}{180} \text{x } 100\% = 0{,}031\%$$

Simpangan :

Simpangan = 180 – 174,5 = 5,5

Standar Deviasi (SD)

$$\text{SD} = \sqrt{\frac{(174 - 174{,}5)^2 + (174 - 174{,}5)^2 + (174 - 174{,}5)^2 + (174 - 174{,}5)^2 + (174 - 174{,}5)^2}{10 - 1}}$$

$$\text{SD} = \sqrt{\frac{(175 - 174{,}5)^2 + (175 - 174{,}5)^2 + (175 - 174{,}5)^2 + (175 - 174{,}5)^2 + (175 - 174{,}5)^2}{10 - 1}}$$

$$\text{SD} = \sqrt{\frac{2{,}5}{10 - 1}} = 0.5270462767$$

Ua (Ketidakpastian):

$$Ua = \frac{0.5270462767}{\sqrt{10}} = 0.1666666667$$

f. Hasil Perhitungan BPM pada Setting 210 BPM

Nilai Rata-rata Pada Display Modul TA:

$$\overline{X} = \frac{206 + 206 + 206 + 206 + 206 + 206 + 206 + 206 + 206 + 206}{10}$$

$$\overline{\text{X}} = \frac{2060}{10} = 206$$

Nilai Rata-rata Pada Pembanding Modul:

$$\overline{X} = \frac{210 + 210 + 210 + 1210 + 210 + 210 + 210 + 210 + 210 + 210}{10}$$

$$\overline{\text{X}} = \frac{2100}{10} = 210$$

Erorr (%):

$$\% = \frac{210 - 206}{210} \text{x } 100\% = 0{,}019\%$$

Simpangan :

Simpangan = 210 – 206 = 4

Standar Deviasi (SD)

$$\text{SD} = \sqrt{\frac{(206-206)^2+(206-206)^2+(206-206)^2+(206-206)^2+(206-206)^2}{10-1}}$$

$$\text{SD} = \sqrt{\frac{(206-206)^2+(206-206)^2+(206-206)^2+(206-206)^2+(206-206)^2}{10-1}}$$

$$\text{SD} = \sqrt{\frac{0}{10-1}} = 0$$

Ua (Ketidakpastian):

$$Ua = \frac{0}{\sqrt{10}} = 0$$

g. Hasil Perhitungan BPM pada Setting 240 BPM

Nilai Rata-rata Pada Display Modul TA:

$$\overline{X} = \frac{240+240+240+240+240+240+240+240+240+240}{10}$$

$$\overline{\text{X}} = \frac{2400}{10} = 240$$

Nilai Rata-rata Pada Pembanding Modul:

$$\overline{X} = \frac{240+240+240+240+240+240+240+240+240+240}{10}$$

$$\overline{\text{X}} = \frac{2400}{10} = 240$$

Erorr (%):

$$\% = \frac{240-240}{240} \text{x } 100\% = 0\%$$

Simpangan :

Simpangan = 240 – 240 = 0

Standar Deviasi (SD)

$$\text{SD} = \sqrt{\frac{(240-240)^2+(240-240)^2+(240-240)^2+(240-240)^2+(240-240)^2}{10-1}}$$

$$\text{SD} = \sqrt{\frac{(240-240)^2+(240-240)^2+(240-240)^2+(240-240)^2+(240-240)^2}{10-1}}$$

$$\text{SD} = \sqrt{\frac{0}{10-1}} = 0$$

Ua (Ketidakpastian):

$$Ua = \frac{0}{\sqrt{10}} = 0$$

2. Listing Program

```
#include <mega8.h>

#include <delay.h>

#include <stdlib.h>

#include <alcd.h>

int bpm;

   unsigned char temp [5];
   int a;
   Timer1 overflow interrupt service routine
   interrupt [TIM1_OVF] void timer1_ovf_isr(void)
   {
   // Reinitialize Timer1 value
   TCNT1H=0xBDC >> 8;
   TCNT1L=0xBDC & 0xff;
   // Place your code here
   }
   // Declare your global variables here
   void setbpm()
   {
       lcd_gotoxy(0,0);
       lcd_putsf("SETTING BPM");
       itoa (bpm,temp);
       lcd_gotoxy(0,1);
       lcd_puts(temp);
   }
   void start()
   {
       lcd_clear();
       lcd_gotoxy(0,0);
       lcd_putsf("BPM");
       itoa (bpm,temp);
       lcd_gotoxy(4,0);
       lcd_puts (temp);
       lcd_gotoxy(0,1);
       lcd_putsf("Proses");
   }
   void main(void)
   {
   bpm=60;
   // Declare your local variables here
```

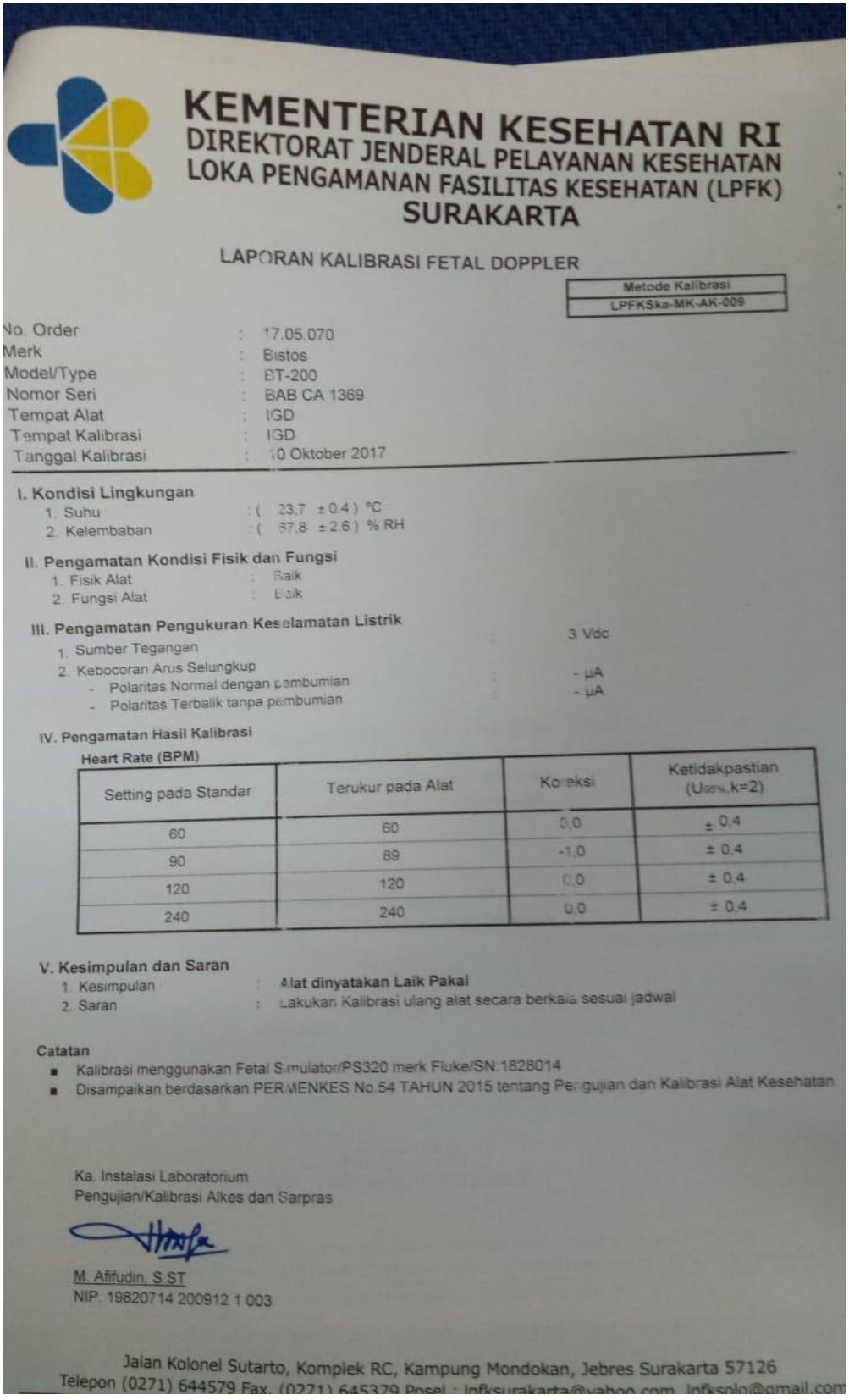
```
// Input/Output Ports initialization

// Port B initialization
// Func7=In Func6=In Func5=In Func4=In Func3=In
Func2=In Func1=In Func0=In
// State7=T State6=T State5=T State4=T State3=P
State2=P State1=P State0=T
PORTB=0x0E;
DDRB=0x00;
// Port C initialization

// Func6=In Func5=In Func4=In Func3=In Func2=In
Func1=In Func0=In

// State6=T State5=T State4=T State3=T State2=T
State1=T State0=T
PORTC=0x00;
DDRC=0x00;

// Port D initialization
// Func7=Out Func6=Out Func5=Out Func4=Out
Func3=Out Func2=Out Func1=Out Func0=Out
// State7=0 State6=0 State5=0 State4=0 State3=0
State2=0 State1=0 State0=0
PORTD=0x00;
DDRD=0xFF;

// Timer/Counter 0 initialization
// Clock source: System Clock
// Clock value: Timer 0 Stopped
TCCR0=0x00;
TCNT0=0x00;

// Timer/Counter 1 initialization
// Clock source: System Clock
// Clock value: 62,500 kHz
// Mode: Normal top=0xFFFF
// OC1A output: Discon.
// OC1B output: Discon.
// Noise Canceler: Off
// Input Capture on Falling Edge
// Timer1 Overflow Interrupt: On
// Input Capture Interrupt: Off
// Compare A Match Interrupt: Off
// Compare B Match Interrupt: Off
TCCR1A=0x00;
TCCR1B=0x04;
```

```
TCNT1H=0x0B;
TCNT1L=0xDC;
ICR1H=0x00;
ICR1L=0x00;
OCR1AH=0x00;
OCR1AL=0x00;
OCR1BH=0x00;
OCR1BL=0x00;

// Timer/Counter 2 initialization
// Clock source: System Clock
// Clock value: Timer2 Stopped
// Mode: Normal top=0xFF
// OC2 output: Disconnected
ASSR=0x00;
TCCR2=0x00;
TCNT2=0x00;
OCR2=0x00;

// External Interrupt(s) initialization
// INT0: Off
// INT1: Off
MCUCR=0x00;
// Timer(s)/Counter(s) Interrupt(s)
initialization
TIMSK=0x04;
// USART initialization
// USART disabled
UCSRB=0x00;
// Analog Comparator initialization
// Analog Comparator: Off
// Analog Comparator Input Capture by
Timer/Counter 1: Off
ACSR=0x80;
SFIOR=0x00;
// ADC initialization
// ADC disabled
ADCSRA=0x00;
// SPI initialization
// SPI disabled
SPCR=0x00;
// TWI initialization
// TWI disabled
TWCR=0x00;
// Alphanumeric LCD initialization
// Connections specified in the
```

```
// Project|Configure|C
Compiler|Libraries|Alphanumeric LCDmenu:
//RS - PORTC Bit 0
// RD - PORTB Bit 7
// EN - PORTC Bit 1
// D4 - PORTC Bit 2
// D5 - PORTC Bit 3
// D6 - PORTC Bit 4
// D7 - PORTC Bit 5
// Characters/line: 16
lcd_init(16);
// Global enable interrupts
#asm("sei")
lcd_gotoxy(0,0);
lcd_putsf("SIMULATOR BPM");
lcd_gotoxy(0,1);

lcd_putsf("U FETAL DOPPLER");

delay_ms(100);
lcd_clear();
lcd_gotoxy(0,0);
lcd_putsf("Sari Maharani");
lcd_gotoxy(0,1);
lcd_putsf("20153010042");
delay_ms (100);
lcd_clear();
bpm=0;
while (1)
    {
 satu:
  while(1)
  {
    setbpm();
    if (!PINB.1)
    {

     bpm=bpm+30;

      delay_ms(200);
      if (bpm>240)
        {
        lcd_clear();
        bpm=60;
        }
      }
    else if(!PINB.2)
```

```
          {
          bpm=bpm-30;
          delay_ms(200);
          lcd_clear();
          if (bpm<60)
          {
           bpm=240;
          }
          }
        if (PINB.3==0)
        {
         delay_ms(200);
         lcd_clear();
         goto dua;
        }
      }
     }
    dua:
      while(1)
      {
        start();
        if(PINB.3==0)
        {
         while(PINB.3==0){}
         delay_ms(200);
         lcd_clear();
         goto satu;
        }
        if(bpm==60)
        {
            PORTD.3=1;
            delay_ms(620);
            PORTD.3=0;
            delay_ms(360);
        }
        else if(bpm==90)
        {
            PORTD.3=1;
            delay_ms(410);
            PORTD.3=0;
            delay_ms(220);
        }
          else if(bpm==120)
```

```
        {
            PORTD.3=1;
            delay_ms(288);
            PORTD.3=0;
            delay_ms(200);
        }
        else if (bpm==150)
        {

         PORTD.3=1;

            delay_ms(225);
            PORTD.3=0;
            delay_ms(170);
        }
        else if (bpm==180)
        {
            PORTD.3=1;
            delay_ms(211);
            PORTD.3=0;
            delay_ms(115);
        }
        else if (bpm==210)
        {
            PORTD.3=1;
            delay_ms(176);
            PORTD.3=0;
            delay_ms(101);
        }
        else if (bpm==240)
        {
            PORTD.3=1;
            delay_ms(140);
            PORTD.3=0;
            delay_ms(100);
        }
     }
    }
```



KEMENTERIAN KESEHATAN RI
DIREKTORAT JENDERAL PELAYANAN KESEHATAN
LOKA PENGAMANAN FASILITAS KESEHATAN (LPFK) SURAKARTA

LAPORAN KALIBRASI FETAL DOPPLER

Metode Kalibrasi
LPFKSka-MK-AK-009

No. Order : 17.05.070
Merk : Bistos
Model/Type : BT-200
Nomor Seri : BAB CA 1369
Tempat Alat : IGD
Tempat Kalibrasi : IGD
Tanggal Kalibrasi : 10 Oktober 2017

I. Kondisi Lingkungan
1. Suhu : (23,7 ± 0.4) °C
2. Kelembaban : (57,8 ± 2.6) % RH

II. Pengamatan Kondisi Fisik dan Fungsi
1. Fisik Alat : Baik
2. Fungsi Alat : Baik

III. Pengamatan Pengukuran Keselamatan Listrik
1. Sumber Tegangan : 3 Vdc
2. Kebocoran Arus Selungkup
   - Polaritas Normal dengan pembumian : - µA
   - Polaritas Terbalik tanpa pembumian : - µA

IV. Pengamatan Hasil Kalibrasi

Heart Rate (BPM)

Setting pada Standar	Terukur pada Alat	Koreksi	Ketidakpastian ($U_{95\%}$, k=2)
60	60	0.0	± 0.4
90	89	-1.0	± 0.4
120	120	0.0	± 0.4
240	240	0.0	± 0.4

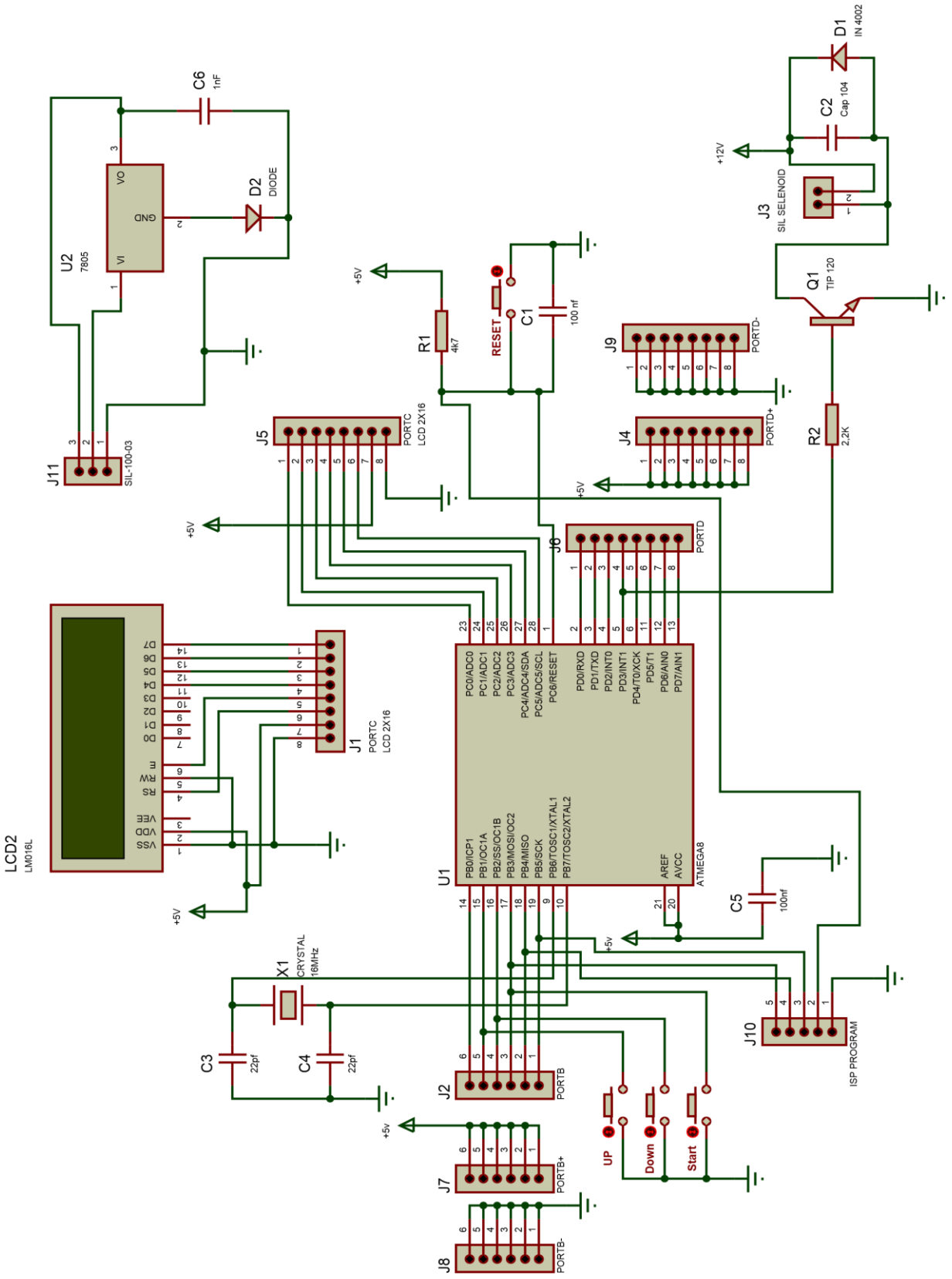
V. Kesimpulan dan Saran
1. Kesimpulan : **Alat dinyatakan Laik Pakai**
2. Saran : Lakukan Kalibrasi ulang alat secara berkala sesuai jadwal

Catatan
- Kalibrasi menggunakan Fetal Simulator/PS320 merk Fluke/SN:1828014
- Disampaikan berdasarkan PERMENKES No.54 TAHUN 2015 tentang Pengujian dan Kalibrasi Alat Kesehatan

Ka. Instalasi Laboratorium
Pengujian/Kalibrasi Alkes dan Sarpras

M. Afifudin, S.ST
NIP. 19820714 200912 1 003

Jalan Kolonel Sutarto, Komplek RC, Kampung Mondokan, Jebres Surakarta 57126
Telepon (0271) 644579 Fax. (0271) 645379 Posel : lpfksurakarta@yahoo.com, lpfksolo@gmail.com


U2
7805
VO
GND
VI
C6
1nF
D2
DIODE
J11
SIL-100-03
D1
IN 4002
C2
Cap 104
+12V
J3
SIL SELENOID
Q1
TIP 120
R2
2.2K
R1
4k7
RESET
C1
100 nf
+5V
J9
PORTD-
J4
PORTD+
J5
PORTC
LCD 2X16
J6
PORTD
LCD2
LM016L
J1
PORTC
LCD 2X16
U1
ATMEGA8
PC0/ADC0
PC1/ADC1
PC2/ADC2
PC3/ADC3
PC4/ADC4/SDA
PC5/ADC5/SCL
PC6/RESET
PD0/RXD
PD1/TXD
PD2/INT0
PD3/INT1
PD4/T0/XCK
PD5/T1
PD6/AIN0
PD7/AIN1
PB0/ICP1
PB1/OC1A
PB2/SS/OC1B
PB3/MOSI/OC2
PB4/MISO
PB5/SCK
PB6/TOSC1/XTAL1
PB7/TOSC2/XTAL2
AREF
AVCC
C5
100nf
X1
CRYSTAL
16MHz
C3
22pf
C4
22pf
J2
PORTB
J10
ISP PROGRAM
UP
Down
Start
J7
PORTB+
J8
PORTB-