LAMPIRAN A
PROGRAM PADA CODEVISION AVR

```
/*****************************
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CodeWizardAVR V1.25.3 Standard
Automatic Program Generator
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Project :
Version :
Date    : 6/3/2013
Author  : Julio
Company : Indonesia
Comments:


Chip type           : ATmega16
Program type        : Application
Clock frequency     : 12.000000 MHz
Memory model        : Small
External SRAM size  : 0
Data Stack size     : 256
*****************************/

#include <mega16.h>
#include <stdio.h>
#include <delay.h>
#define ADC_VREF_TYPE 0x00

// Read the AD conversion result
unsigned int read_adc(unsigned char
adc_input)
{
ADMUX=adc_input |
(ADC_VREF_TYPE & 0xff);
// Start the AD conversion
ADCSRA|=0x40;
// Wait for the AD conversion to
complete
while ((ADCSRA & 0x10)==0);
ADCSRA|=0x10;
return ADCW;
}

// Declare your global variables here
unsigned int
temp0,temp1,temp2,temp3,temp4;
unsigned int sw;

void play(unsigned char nomor)
{
 unsigned char temp;
 temp=nomor;
 PORTD.1=0;
 delay_ms(10);
 PORTB=temp;
 delay_ms(10);
 PORTD.1=1;
 for(;;)
 {if(PIND.0==0)break;}
```

```
 for(;;)
 {
  if(PIND.0==1)break;
 }
}

void main(void)
{
// Declare your local variables here

// Input/Output Ports initialization
// Port A 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=T State2=T
State1=T State0=T
PORTA=0xFF;
DDRA=0x00;

// Port B initialization
// Func7=Out Func6=Out Func5=Out
Func4=Out Func3=Out Func2=Out
Func1=Out Func0=Out
// State7=1 State6=1 State5=1
State4=1 State3=1 State2=1 State1=1
State0=1
PORTB=0xFF;
DDRB=0xFF;

// Port C 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=T State2=T
State1=T State0=T
PORTC=0xFF;
DDRC=0xFF;

// Port D 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=T State2=T
State1=T State0=T
PORTD=0x00;
DDRD=0x00;

// Timer/Counter 0 initialization
// Clock source: System Clock
// Clock value: Timer 0 Stopped
// Mode: Normal top=FFh
// OC0 output: Disconnected
TCCR0=0x00;
TCNT0=0x00;
OCR0=0x00;

// Timer/Counter 1 initialization
// Clock source: System Clock
```

```
// Clock value: Timer 1 Stopped
// Mode: Normal top=FFFFh
// OC1A output: Discon.
// OC1B output: Discon.
// Noise Canceler: Off
// Input Capture on Falling Edge
// Timer 1 Overflow Interrupt: Off
// Input Capture Interrupt: Off
// Compare A Match Interrupt: Off
// Compare B Match Interrupt: Off
TCCR1A=0x00;
TCCR1B=0x00;
TCNT1H=0x00;
TCNT1L=0x00;
ICR1H=0x00;
ICR1L=0x00;
OCR1AH=0x00;
OCR1AL=0x00;
OCR1BH=0x00;
OCR1BL=0x00;

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

// External Interrupt(s) initialization
// INT0: Off
// INT1: Off
// INT2: Off
MCUCR=0x00;
MCUCSR=0x00;

// Timer(s)/Counter(s) Interrupt(s)
initialization
TIMSK=0x00;

// Analog Comparator initialization
// Analog Comparator: Off
// Analog Comparator Input Capture
by Timer/Counter 1: Off
ACSR=0x80;
SFIOR=0x00;

// ADC initialization
// ADC Clock frequency: 187.500
kHz
// ADC Voltage Reference: AREF
pin
// ADC Auto Trigger Source: None
ADMUX=ADC_VREF_TYPE &
0xff;
ADCSRA=0x86;

DDRD.1=1; PORTD.1=1;
DDRD.0=0; PORTD.0=1;
DDRD.3=0;
```

```
sw=0;
while (1)
{ // Place your code here
if(PIND.3==0 && sw==0)
{sw=1; PORTC.0=0;}
if(PIND.3==0 && sw==1)
{sw=0; PORTC.0=1;}
temp0=read_adc(0);
temp1=read_adc(1);
temp2=read_adc(2);
temp3=read_adc(3);
temp4=read_adc(4);
if(sw==0)
{
if((temp0>=902 && temp0<=943) && (temp1>=922 && temp1<=963) &&
(temp2>=1004 && temp2<=1024) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(254);} //Ucapan A
else if((temp0>=614 && temp0<=656) && (temp1>=656 && temp1<=697) &&
(temp2>=758 && temp2<=779) && (temp3>=779 && temp3<=820) &&
(temp4>=512 && temp4<=594))
{play(253);} //Ucapan B
else if((temp0>=738 && temp0<=800) && (temp1>=758 && temp1<=779) &&
(temp2>=820 && temp2<=861) && (temp3>=881 && temp3<=922) &&
(temp4>=779 && temp4<=820))
{play(252);} //Ucapan C
else if((temp0>=636 && temp0<=656) && (temp1>=718 && temp1<=758) &&
(temp2>=820 && temp2<=861) && (temp3>=943 && temp3<=984) &&
(temp4>=779 && temp4<=820))
{play(251);} //Ucapan D
```

```
else if((temp0>=881 && temp0<=922) && (temp1>=840 && temp1<=881) &&
(temp2>=943 && temp2<=984) && (temp3>=1004 && temp3<=1024) &&
(temp4>=533 && temp4<=574))
{play(250);} //Ucapan E
else if((temp0>=840 && temp0<=881) && (temp1>=656 && temp1<=697) &&
(temp2>=758 && temp2<=800) && (temp3>=800 && temp3<=820) &&
(temp4>=656 && temp4<=697))
{play(249);} //Ucapan F
else if((temp0>=656 && temp0<=697) && (temp1>=902 && temp1<=943) &&
(temp2>=984 && temp2<=1024) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(248);} //Ucapan G
else if((temp0>=636 && temp0<=677) && (temp1>=677 && temp1<=697) &&
(temp2>=943 && temp2<=984) && (temp3>=1004 && temp3<=1024) &&
(temp4>=738 && temp4<=820))
{play(247);} //Ucapan H
else if((temp0>=861 && temp0<=922) && (temp1>=820 && temp1<=861) &&
(temp2>=902 && temp2<=943) && (temp3>=779 && temp3<=820) &&
(temp4>=594 && temp4<=656))
{play(246);} //Ucapan I
else if((temp0>=636 && temp0<=656) && (temp1>=677 && temp1<=697) &&
(temp2>=922 && temp2<=943) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(244);} //Ucapan K
else if((temp0>=614 && temp0<=656) && (temp1>=902 && temp1<=943) &&
(temp2>=922 && temp2<=984) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(243);} //Ucapan L
else if((temp0>=861 && temp0<=902) && (temp1>=779 && temp1<=820) &&
(temp2>=881 && temp2<=922) && (temp3>=1004 && temp3<=1024) &&
(temp4>=656 && temp4<=697))
```

```
{play(242);} //Ucapan M
else if((temp0>=800 && temp0<=840) && (temp1>=758 && temp1<=800) &&
(temp2>=902 && temp2<=943) && (temp3>=1004 && temp3<=1024) &&
(temp4>=758 && temp4<=820))
{play(241);} //Ucapan N
else if((temp0>=779 && temp0<=820) && (temp1>=779 && temp1<=820) &&
(temp2>=881 && temp2<=922) && (temp3>=963 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(240);} //Ucapan O
else if((temp0>=614 && temp0<=656) && (temp1>=697 && temp1<=718) &&
(temp2>=922 && temp2<=963) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(239);} //Ucapan P
else if((temp0>=656 && temp0<=697) && (temp1>=820 && temp1<=861) &&
(temp2>=943 && temp2<=984) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(238);} //Ucapan Q
else if((temp0>=677 && temp0<=697) && (temp1>=677 && temp1<=697) &&
(temp2>=922 && temp2<=963) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(237);} //Ucapan R
else if((temp0>=902 && temp0<=943) && (temp1>=922 && temp1<=963) &&
(temp2>=984 && temp2<=1024) && (temp3>=1004 && temp3<=1024) &&
(temp4>=677 && temp4<=758))
{play(236);} //Ucapan S
else if((temp0>=697 && temp0<=738) && (temp1>=881 && temp1<=922) &&
(temp2>=963 && temp2<=1004) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(235);} //Ucapan T
```

```
else if((temp0>=636 && temp0<=677) && (temp1>=677 && temp1<=718) &&
(temp2>=922 && temp2<=963) && (temp3>=1004 && temp3<=1024) &&
(temp4>=758 && temp4<=820))
{play(234);} //Ucapan U
else if((temp0>=697 && temp0<=738) && (temp1>=718 && temp1<=758) &&
(temp2>=1004 && temp2<=1024) && (temp3>=1004 && temp3<=1024) &&
(temp4>=738 && temp4<=779))
{play(233);} //Ucapan V
else if((temp0>=636 && temp0<=677) && (temp1>=656 && temp1<=697) &&
(temp2>=779 && temp2<=800) && (temp3>=963 && temp3<=1004) &&
(temp4>=779 && temp4<=820))
{play(232);} //Ucapan W
else if((temp0>=758 && temp0<=800) && (temp1>=922 && temp1<=963) &&
(temp2>=1004 && temp2<=1024) && (temp3>=1004 && temp3<=1024) &&
(temp4>=656 && temp4<=738))
{play(231);} //Ucapan X
else if((temp0>=840 && temp0<=902) && (temp1>=840 && temp1<=902) &&
(temp2>=943 && temp2<=984) && (temp3>=800 && temp3<=820) &&
(temp4>=779 && temp4<=820))
{play(230);} //Ucapan Y
else if((temp0>=636 && temp0<=677) && (temp1>=881 && temp1<=922) &&
(temp2>=984 && temp2<=1024) && (temp3>=1004 && temp3<=1024) &&
(temp4>=677 && temp4<=758))
{play(229);} //Ucapan Z
}
If(sw==1)
{
if((temp0>=779 && temp0<=820) && (temp1>=779 && temp1<=820) &&
(temp2>=881 && temp2<=922) && (temp3>=963 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(228);} //Ucapan Nol
```

```
else if((temp0>=636 && temp0<=677) && (temp1>=881 && temp1<=922) &&
(temp2>=984 && temp2<=1024) && (temp3>=1004 && temp3<=1024) &&
(temp4>=677 && temp4<=758))
{play(227);} //Ucapan Satu
else if((temp0>=636 && temp0<=677) && (temp1>=677 && temp1<=718) &&
(temp2>=922 && temp2<=963) && (temp3>=1004 && temp3<=1024) &&
(temp4>=758 && temp4<=820))
{play(226);} //Ucapan Dua
else if((temp0>=636 && temp0<=677) && (temp1>=677 && temp1<=718) &&
(temp2>=922 && temp2<=963) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(225);} //Ucapan Tiga
else if((temp0>=614 && temp0<=656) && (temp1>=656 && temp1<=697) &&
(temp2>=758 && temp2<=779) && (temp3>=779 && temp3<=820) &&
(temp4>=512 && temp4<=594))
{play(224);} //Ucapan Empat
else if((temp0>=636 && temp0<=677) && (temp1>=656 && temp1<=697) &&
(temp2>=758 && temp2<=800) && (temp3>=800 && temp3<=840) &&
(temp4>=779 && temp4<=820))
{play(223);} //Ucapan Lima
else if((temp0>=636 && temp0<=677) && (temp1>=697 && temp1<=738) &&
(temp2>=758 && temp2<=800) && (temp3>=1004 && temp3<=1024) &&
(temp4>=779 && temp4<=820))
{play(222);} //Ucapan Enam
else if((temp0>=656 && temp0<=697) && (temp1>=656 && temp1<=697) &&
(temp2>=861 && temp2<=902) && (temp3>=800 && temp3<=840) &&
(temp4>=779 && temp4<=820))
{play(221);} //Ucapan Tujuh
else if((temp0>=656 && temp0<=697) && (temp1>=758 && temp1<=800) &&
(temp2>=779 && temp2<=820) && (temp3>=800 && temp3<=840) &&
(temp4>=779 && temp4<=820))
```

```
{play(220);} //Ucapan Delapan
else if((temp0>=758 && temp0<=800) && (temp1>=656 && temp1<=697) &&
(temp2>=758 && temp2<=800) && (temp3>=800 && temp3<=840) &&
(temp4>=779 && temp4<=820))
{play(219);} //Ucapan Sembilan
else if((temp0>=861 && temp0<=922) && (temp1>=820 && temp1<=861) &&
(temp2>=902 && temp2<=943) && (temp3>=779 && temp3<=820) &&
(temp4>=594 && temp4<=656))
{play(245);} //Ucapan J
}
    };
}
```

LAMPIRAN B
PENGUJIAN TEGANGAN PADA MASING-MASING *FLEX* SENSOR UNTUK SETIAP KARAKTER (HURUF DAN ANGKA)

Pengujian dilakukan untuk menentukan tegangan pada setiap *flex* sensor dalam mewakili sebuah karakter (huruf dan angka). Pengujian dilakukan sebanyak 5 kali untuk setiap karakter. Hasil pengujian ditunjukkan oleh Tabel B.1.

Tabel B.1 Tegangan pada Masing-Masing *Flex* Sensor untuk Setiap Karakter

Karakter (Huruf / Angka)	Tegangan *Flex* Sensor (Volt / Nilai Dijital)				
	Ibu Jari	Telunjuk	Jari Tengah	Jari Manis	Kelingking
	4 (820)	4,5 (922)	4,5 (922)	4,9 (1004)	5 (1023)
	4 (820)	4,5 (922)	4,7 (963)	4,9 (1004)	5 (1023)
A	4 (820)	4,4 (902)	4,6 (943)	5 (1023)	5 (1023)
	3,8 (779)	4,5 (922)	4,6 (943)	5 (1023)	5 (1023)
	4 (820)	4,6 (943)	4,5 (922)	5 (1023)	5 (1023)
	2,6 (533)	3,1 (636)	3,3 (677)	3,8 (779)	3,9 (800)
	2,6 (533)	3,2 (656)	3,3 (677)	3,7 (758)	4 (820)
B	2,8 (574)	3,1 (636)	3,4 (697)	3,8 (779)	4 (820)
	2,8 (574)	3,1 (636)	3,3 (677)	3,8 (779)	3,9 (800)
	2,9 (594)	3,1 (636)	3,3 (677)	3,7 (758)	3,9 (800)
	4 (820)	3,8 (779)	3,8 (779)	4,1 (840)	4,4 (902)
	4 (820)	3,7 (758)	3,6 (738)	4 (820)	4,5 (922)
C	3,8 (779)	3,8 (779)	3,6 (738)	4,1 (840)	4,4 (902)
	4 (820)	3,8 (779)	3,7 (758)	4,1 (840)	4,4 (902)
	4 (820)	3,9 (800)	3,7 (758)	4,2 (861)	4,5 (922)
	4 (820)	3,1 (636)	3,5 (718)	4,1 (840)	4,7 (963)
	4 (820)	3,2 (656)	3,6 (738)	4,1 (840)	4,8 (984)
D	4 (820)	3,2 (656)	3,6 (738)	4,2 (861)	4,7 (963)
	3,8 (779)	3,3 (677)	3,6 (738)	4,2 (861)	4,7 (963)
	4 (820)	3,2 (656)	3,6 (738)	4 (820)	4,6 (943)
	2,6 (533)	4,5 (922)	4,3 (881)	4,7 (963)	5 (1023)
E	2,5 (512)	4,4 (902)	4,3 (881)	4,7 (963)	5 (1023)
	2,6 (533)	4,5 (922)	4,2 (861)	4,8 (984)	5 (1023)

	2,8 (574)	4,3 (881)	4,2 (861)	4,7 (963)	5 (1023)
	2,4 (492)	4,4 (902)	4,2 (861)	4,6 (943)	5 (1023)
	3,2 (656)	4,2 (861)	3,3 (677)	3,8 (779)	3,9 (800)
	3,3 (677)	4,1 (840)	3,3 (677)	3,7 (758)	4 (820)
F	3,1 (636)	4,2 (861)	3,4 (697)	3,8 (779)	4 (820)
	3,3 (677)	4,2 (861)	3,3 (677)	3,8 (779)	3,9 (800)
	3,4 (697)	4,3 (881)	3,3 (677)	3,8 (779)	3,9 (800)
	4 (820)	3,3 (677)	4,5 (922)	4,9 (1004)	5 (1023)
	4 (820)	3,4 (697)	4,4 (902)	5 (1023)	5 (1023)
G	3,7 (758)	3,3 (677)	4,4 (902)	4,9 (1004)	5 (1023)
	4 (820)	3,3 (677)	4,5 (922)	4,8 (984)	4,9 (1004)
	4 (820)	3,3 (677)	4,6 (943)	4,9 (1004)	4,9 (1004)
	3,6 (738)	3,2 (656)	3,3 (677)	4,7 (963)	4,9 (1004)
	3,3 (677)	3,1 (636)	3,4 (697)	4,7 (963)	5 (1023)
H	3,6 (738)	3,2 (656)	3,3 (677)	4,8 (984)	5 (1023)
	3,7 (758)	3,2 (656)	3,3 (677)	4,8 (984)	5 (1023)
	3,4 (697)	3,2 (656)	3,2 (656)	4,7 (963)	5 (1023)
	3,2 (656)	4,4 (902)	4 (820)	4,5 (922)	3,9 (800)
	3,1 (636)	4,3 (881)	4,1 (840)	4,6 (943)	3,9 (800)
I	2,8 (574)	4,4 (902)	4 (820)	4,6 (943)	4 (820)
	3,1 (636)	4,4 (902)	4,1 (840)	4,4 (902)	3,9 (800)
	2,9 (594)	4,5 (922)	4,1 (840)	4,5 (922)	4 (820)
	3,2 (656)	4,4 (902)	4 (820)	4,4 (902)	3,9 (800)
	3,1 (636)	4,4 (902)	4,1 (840)	4,5 (922)	3,9 (800)
J	3,1 (636)	4,5 (922)	4,1 (840)	4,5 (922)	3,9 (800)
	2,9 (594)	4,4 (902)	4 (820)	4,6 (943)	3,9 (800)
	3,1 (636)	4,5 (922)	4,1 (840)	4,6 (943)	3,9 (800)
	4 (820)	3,1 (636)	3,3 (677)	4,5 (922)	5 (1023)
	3,8 (779)	3,1 (636)	3,3 (677)	4,6 (943)	5 (1023)
K	4 (820)	3,1 (636)	3,3 (677)	4,5 (922)	5 (1023)
	3,8 (779)	3,2 (656)	3,2 (656)	4,5 (922)	5 (1023)

	4 (820)	3,2 (656)	3,3 (677)	4,5 (922)	5 (1023)
	4 (820)	3,1 (636)	4,5 (922)	4,6 (943)	5 (1023)
	4 (820)	3,1 (636)	4,4 (902)	4,7 (963)	5 (1023)
L	4 (820)	3,1 (636)	4,5 (922)	4,8 (984)	5 (1023)
	4 (820)	3 (614)	4,5 (922)	4,8 (984)	5 (1023)
	4 (820)	3,1 (636)	4,5 (922)	4,7 (963)	5 (1023)
	3,3 (677)	4,3 (881)	3,9 (800)	4,4 (902)	5 (1023)
	3,6 (738)	4,4 (902)	3,9 (800)	4,5 (922)	5 (1023)
M	3,4 (697)	4,3 (881)	4 (820)	4,4 (902)	5 (1023)
	3,2 (656)	4,3 (881)	3,9 (800)	4,4 (902)	4,9 (1004)
	3,3 (677)	4,2 (861)	4(820)	4,5 (922)	5 (1023)
	4 (820)	4,1 (840)	3,8 (779)	4,4 (902)	5 (1023)
	3,8 (779)	4 (820)	3,7 (758)	4,5 (922)	5 (1023)
N	3,8 (779)	4 (820)	3,8 (779)	4,5 (922)	5 (1023)
	3,7 (758)	3,9 (800)	3,8 (779)	4,6 (943)	5 (1023)
	3,7 (758)	4 (820)	3,7 (758)	4,5 (922)	4,9 (1004)
	4 (820)	3,9 (800)	3,9 (800)	4,4 (902)	4,8 (984)
	3,8 (779)	3,9 (800)	3,8 (779)	4,4 (902)	4,9 (1004)
O	4 (820)	4 (820)	3,9 (800)	4,3 (881)	4,9 (1004)
	4 (820)	3,9 (800)	4 (820)	4,4 (902)	4,7 (963)
	4 (820)	3,9 (800)	4 (820)	4,4 (902)	4,7 (963)
	4 (820)	3,2 (656)	3,3 (677)	4,6 (943)	5 (1023)
	4 (820)	3,1 (636)	3,4 (697)	4,7 (963)	5 (1023)
P	4 (820)	3,1 (636)	3,4 (697)	4,6 (943)	5 (1023)
	4 (820)	3,2 (656)	3,4 (697)	4,5 (922)	5 (1023)
	4 (820)	3,1 (636)	3,5 (718)	4,6 (943)	5 (1023)
	4 (820)	3,4 (697)	4,1 (840)	4,7 (963)	5 (1023)
	4 (820)	3,3 (677)	4,2 (861)	4,7 (963)	5 (1023)
Q	4 (820)	3,4 (697)	4,1 (840)	4,7 (963)	5 (1023)
	4 (820)	3,3 (677)	4 (820)	4,7 (963)	5 (1023)
	4 (820)	3,2 (656)	4 (820)	4,6 (943)	5 (1023)

	4 (820)	3,4 (697)	3,4 (697)	4,7 (963)	5 (1023)
	3,7 (758)	3,3 (677)	3,4 (697)	4,6 (943)	5 (1023)
R	4 (820)	3,4 (697)	3,3 (677)	4,6 (943)	5 (1023)
	3,8 (779)	3,4 (697)	3,4 (697)	4,6 (943)	5 (1023)
	4 (820)	3,3 (677)	3,4 (697)	4,5 (922)	5 (1023)
	3,2 (656)	4,5 (922)	4,5 (922)	4,9 (1004)	5 (1023)
	3,4 (697)	4,6 (943)	4,5 (922)	4,9 (1004)	5 (1023)
S	3,4 (697)	4,5 (922)	4,6 (943)	4,8 (984)	5 (1023)
	3,6 (738)	4,4 (902)	4,6 (943)	4,9 (1004)	5 (1023)
	3,6 (738)	4,5 (922)	4,6 (943)	5 (1023)	5 (1023)
	4 (820)	3,4 (697)	4,4 (902)	5 (1023)	5 (1023)
	4 (820)	3,5 (718)	4,5 (922)	4,9 (1004)	5 (1023)
T	4 (820)	3,5 (718)	4,4 (902)	4,8 (984)	5 (1023)
	3,8 (779)	3,5 (718)	4,4 (902)	4,9 (1004)	4,9 (1004)
	3,8 (779)	3,4 (697)	4,4 (902)	4,8 (984)	4,9 (1004)
	4 (820)	3,3 (677)	3,4 (697)	4,5 (922)	5 (1023)
	3,8 (779)	3,2 (656)	3,3 (677)	4,6 (943)	5 (1023)
U	3,6 (738)	3,2 (656)	3,4 (697)	4,7 (963)	5 (1023)
	3,7 (758)	3,3 (677)	3,4 (697)	4,6 (943)	5 (1023)
	3,8 (779)	3,2 (656)	3,3 (677)	4,7 (963)	5 (1023)
	3,7 (758)	3,5 (718)	3,6 (738)	4,8 (984)	5 (1023)
	3,6 (738)	3,5 (718)	3,6 (738)	5 (1023)	5 (1023)
V	3,7 (758)	3,5 (718)	3,5 (718)	4,9 (1004)	5 (1023)
	3,8 (779)	3,6 (738)	3,6 (738)	4,9 (1004)	5 (1023)
	3,6 (738)	3,5 (718)	3,6 (738)	4,8 (984)	5 (1023)
	3,8 (779)	3,3 (677)	3,3 (677)	3,8 (779)	4,8 (984)
	4 (820)	3,2 (656)	3,3 (677)	3,8 (779)	4,7 (963)
W	3,8 (779)	3,2 (656)	3,4 (697)	3,8 (779)	4,8 (984)
	4 (820)	3,3 (677)	3,3 (677)	3,9 (800)	5 (1023)
	4 (820)	3,2 (656)	3,2 (656)	3,8 (779)	4,8 (984)
X	3,1 (636)	3,8 (779)	4,6 (943)	5 (1023)	5 (1023)

	3,3 (677)	3,8 (779)	4,7 (963)	4,9 (1004)	5 (1023)
	3,2 (656)	3,7 (758)	4,6 (943)	5 (1023)	5 (1023)
	3,3 (677)	3,7 (758)	4,6 (943)	5 (1023)	5 (1023)
	3,4 (697)	3,8 (779)	4,6 (943)	5 (1023)	5 (1023)
	4 (820)	4,3 (881)	4,3 (881)	4,6 (943)	3,9 (800)
	4 (820)	4,3 (881)	4,3 (881)	4,8 (984)	4 (820)
Y	4 (820)	4,4 (902)	4,3 (881)	4,7 (963)	3,9 (800)
	4 (820)	4,4 (902)	4,4 (902)	4,7 (963)	3,9 (800)
	4 (820)	4,3 (881)	4,3 (881)	4,6 (943)	3,9 (800)
	3,3 (677)	3,2 (656)	4,4 (902)	5 (1023)	5 (1023)
	3,2 (656)	3,3 (677)	4,5 (922)	4,9 (1004)	5 (1023)
Z	3,4 (697)	3,2 (656)	4,4 (902)	4,9 (1004)	5 (1023)
	3,6 (738)	3,2 (656)	4,4 (902)	4,9 (1004)	5 (1023)
	3,6 (738)	3,3 (677)	4,5 (922)	4,8 (984)	5 (1023)
	4 (820)	3,9 (800)	4 (820)	4,4 (902)	4,9 (1004)
	4 (820)	3,9 (800)	3,9 (800)	4,3 (881)	4,9 (1004)
0	4 (820)	3,9 (800)	3,9 (800)	4,4 (902)	4,8 (984)
	4 (820)	3,8 (779)	4 (820)	4,5 (922)	4,8 (984)
	4 (820)	3,9 (800)	3,9 (800)	4,4 (902)	4,8 (984)
	3,6 (738)	3,2 (656)	4,4 (902)	4,8 (984)	5 (1023)
	3,6 (738)	3,3 (677)	4,4 (902)	4,9 (1004)	5 (1023)
1	3,4 (697)	3,3 (677)	4,5 (922)	4,9 (1004)	5 (1023)
	3,2 (656)	3,2 (656)	4,4 (902)	4,8 (984)	5 (1023)
	3,3 (677)	3,2 (656)	4,4 (902)	4,9 (1004)	5 (1023)
	3,7 (758)	3,2 (656)	3,3 (677)	4,7 (963)	5 (1023)
	3,6 (738)	3,2 (656)	3,4 (697)	4,6 (943)	5 (1023)
2	3,4 (697)	3,3 (677)	3,3 (677)	4,6 (943)	5 (1023)
	3,7 (758)	3,2 (656)	3,4 (697)	4,7 (963)	5 (1023)
	3,8 (779)	3,2 (656)	3,4 (697)	4,6 (943)	5 (1023)
3	4 (820)	3,3 (677)	3,4 (697)	4,6 (943)	5 (1023)
	4 (820)	3,2 (656)	3,3 (677)	4,5 (922)	4,9 (1004)

	4 (820)	3,3 (677)	3,4 (697)	4,6 (943)	4,9 (1004)
	4 (820)	3,1 (636)	3,4 (697)	4,5 (922)	5 (1023)
	4 (820)	3,2 (656)	3,4 (697)	4,6 (943)	5 (1023)
	2,5 (512)	3,1 (636)	3,2 (656)	3,8 (779)	4 (820)
	2,8 (574)	3 (614)	3,2 (656)	3,7 (758)	3,9 (800)
4	2,9 (594)	3,1 (636)	3,3 (677)	3,7 (758)	3,9 (800)
	2,8 (574)	3,2 (656)	3,3 (677)	3,8 (779)	3,9 (800)
	2,9 (594)	3,1 (636)	3,3 (677)	3,8 (779)	3,9 (800)
	4 (820)	3,2 (656)	3,2 (656)	3,8 (779)	3,9 (800)
	4 (820)	3,2 (656)	3,3 (677)	3,8 (779)	4 (820)
5	4 (820)	3,1 (636)	3,2 (656)	3,8 (779)	4 (820)
	4 (820)	3,2 (656)	3,3 (677)	3,7 (758)	3,9 (800)
	4 (820)	3,2 (656)	3,3 (677)	3,8 (779)	4 (820)
	4 (820)	3,3 (677)	3,4 (697)	3,8 (779)	5 (1023)
	4 (820)	3,2 (656)	3,4 (697)	3,7 (758)	5 (1023)
6	3,7 (758)	3,2 (656)	3,5 (718)	3,8 (779)	5 (1023)
	4 (820)	3,3 (677)	3,5 (718)	3,8 (779)	5 (1023)
	3,8 (779)	3,2 (656)	3,5 (718)	3,7 (758)	5 (1023)
	4 (820)	3,4 (697)	3,3 (677)	4,4 (902)	3,9 (800)
	4 (820)	3,3 (677)	3,3 (677)	4,3 (881)	4 (820)
7	3,8 (779)	3,4 (697)	3,3 (677)	4,3 (881)	4 (820)
	4 (820)	3,3 (677)	3,4 (697)	4,2 (861)	3,9 (800)
	4 (820)	3,3 (677)	3,3 (677)	4,3 (881)	4 (820)
	4 (820)	3,2 (656)	3,8 (779)	3,8 (779)	3,9 (800)
	4 (820)	3,2 (656)	3,9 (800)	3,9 (800)	4 (820)
8	4 (820)	3,3 (677)	3,7 (758)	3,9 (800)	4 (820)
	3,8 (779)	3,4 (697)	3,8 (779)	3,8 (779)	4 (820)
	4 (820)	3,3 (677)	3,7 (758)	3,9 (800)	4,1 (840)
	4 (820)	3,7 (758)	3,3 (677)	3,8 (779)	4 (820)
9	4 (820)	3,8 (779)	3,2 (656)	3,7 (758)	4 (820)
	4 (820)	3,8 (779)	3,3 (677)	3,8 (779)	4,1 (840)

4 (820)	3,7 (758)	3,3 (677)	3,8 (779)	4 (820)
4 (820)	3,8 (779)	3,4 (697)	3,8 (779)	3,9 (800)

LAMPIRAN C

DATASHEET FLEX SENSOR, MODUL SUARA TDR025 DAN KIT PENGOTROL MIKRO ATMEGA16

C.1 *DATASHEET FLEX* SENSOR 4,5 INCI

Features

- Angle Displacement Measurement
- Bends and Flexes physically with motion device
- Possible Uses
- Robotics
- Gaming (Virtual Motion)
- Medical Devices
- Computer Peripherals
- Musical Instruments
- Physical Therapy
- Simple Construction
- Low Profile

Mechanical Specification

-Life Cycle: >1 million

-Height: 0.43mm (0.017")

-Temperature Range: -35°C to +80°C

Electrical Specification

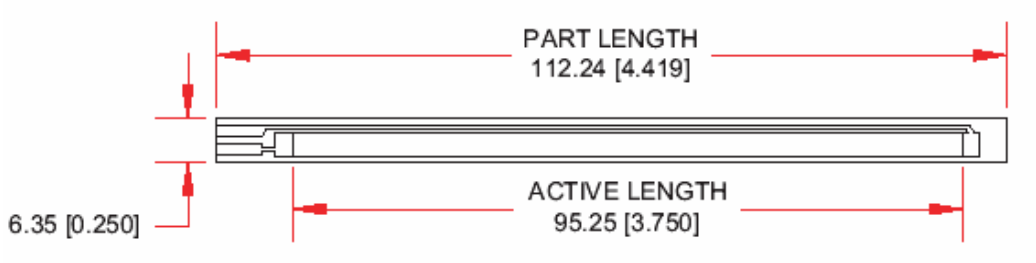
-Flat Resistance: 10K Ohms

-Resistance Tolerance: ±30%

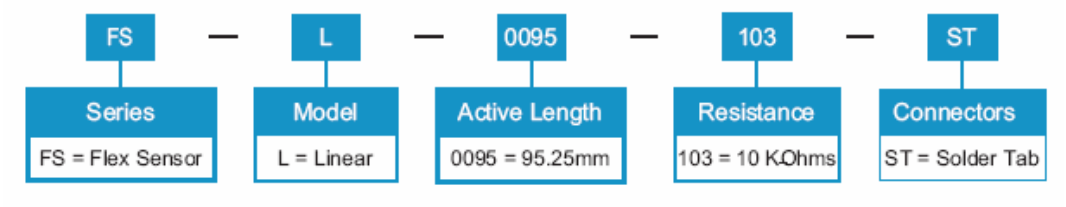
-Bend Resistance Range: 60K to 110K Ohms

-Power Rating : 0.50 Watts continuous. 1 Watt Peak

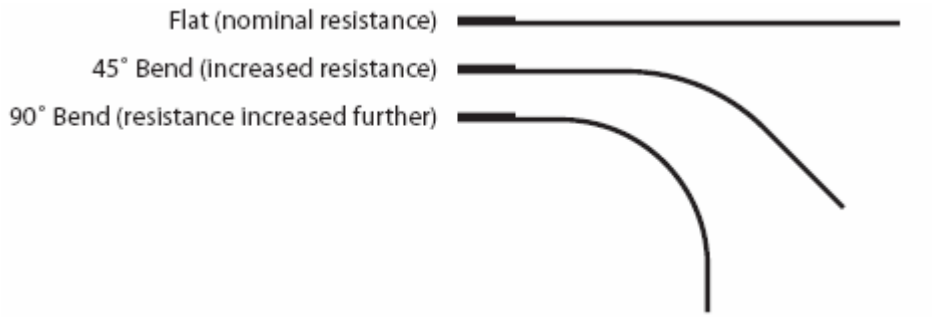
Dimensional Diagram - Stock Flex Sensor



How to Order - Stock Flex Sensor



How It Works



C.2 *DATASHEET FLEX* SENSOR 2,2 INCI

Mechanical Specification

-Life Cycle: >1 million

-Height: 0.43mm (0.017")

-Temperature Range: -35°C to +80°C

Electrical Specification

-Flat Resistance: 25K Ohms

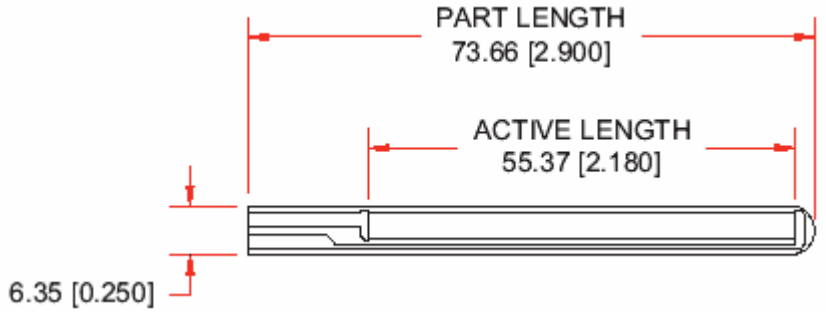
-Resistance Tolerance: ±30%

-Bend Resistance Range: 45K to 125K Ohms

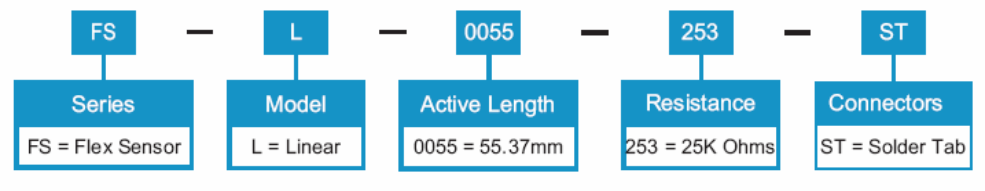
(depending on bend radius)

-Power Rating : 0.50 Watts continuous. 1 Watt Peak

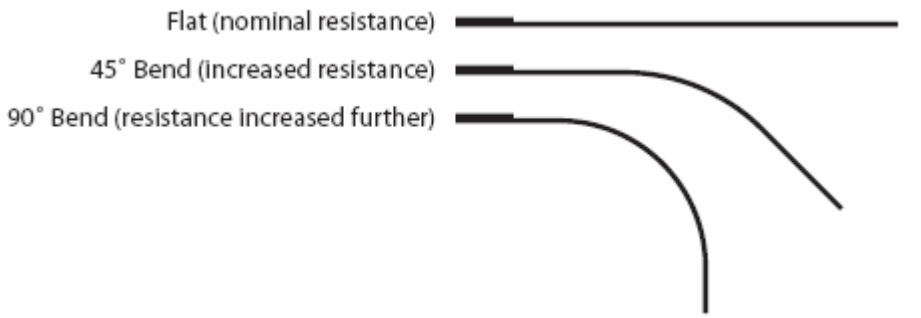
Dimensional Diagram - Stock Flex Sensor



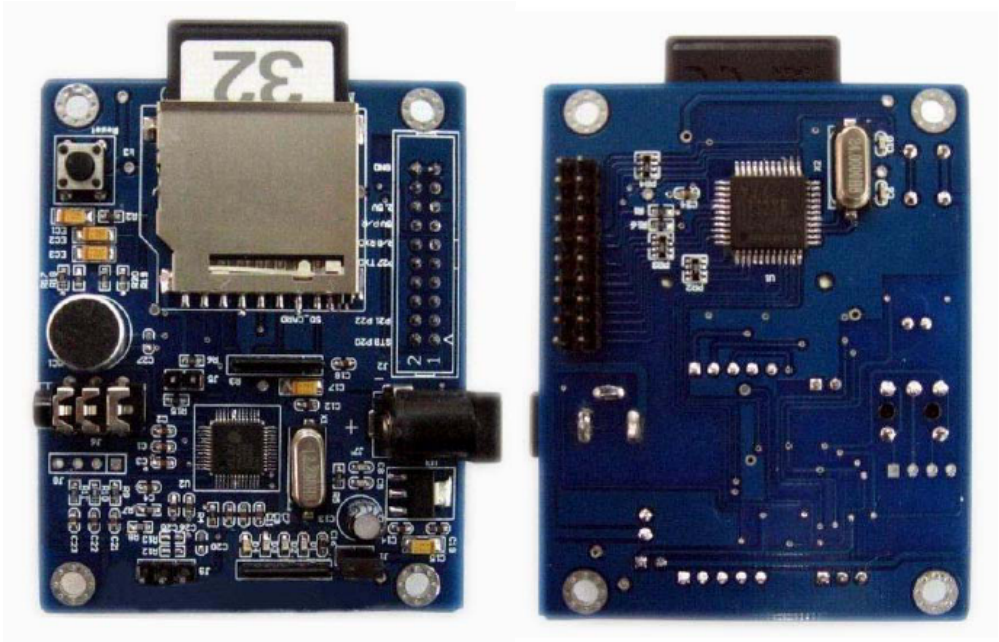
How to Order - Stock Flex Sensor



How It Works



C.3 *DATASHEET* MODUL SUARA TDR025



1. Features Description

>Module support MP3 ,WMA,WAV ,MIDI

Decodes MPEG 1&2 audio layer III (CBR+VBR+ABR)

WMA 4.0/4.1/7/8/9 all profiles (5-384kbit/s)

WAV (PCM +IMA ADPCM ,General MIDI/SP-MIDI files

>Up to 48KHz playback frequency rate and 16KHz recording frequency rate

>Easy to update the files get the recorded file from the memory card

>Module can be controlled by MCU or PLC controller to satisfy many applications

>32Mb SD card can record more than 2 hours , module support 2GB maximum

> 8 types operating mode for users

> Support all range MPEG 1&@ audio layer 3 (ISO11172-3) coding (include CBR , VBR , ABR) , and WMA , WAV also MIDI

> DAC 18 bit ,Dynamic range 90dB , SNR 85dB

>On-board Mic for recording

>Support Auto-record and MCU to control record

>Support 32Mb to 2Gb MMC ,SD,Mini SD,TF card.

>Memory card should format to FAT16 format

>Maximum 500 Folders and 60000 files in each one

> Multiple Operating mode to satisfy user requirement

>Support Auto – play function , no need special file's name

>0 to 250 level smoothy volume , volume can be control via serial port , the volume value can be checked via serial port , there are 16 voluem levels by Key

>Size 57mm * 71.5mm

>Operating power DC 3.7V to 9.1V

>Direct dirive 32 ohms headphone and external ammplifer

> On-Board EEPROM , can read and write via serial port

>Module can connect to 3.3v or 5V MCU

> Module working status and playing schedule can catch by command via serial port

> Can control the module via serial port als by J2 pins at the same time

> When the module working in Mode 2 , have 8 GPIO (fully compatible with MCS-51) , can read I/O value and write GPIO , accomplish periphery controlling

2. Working Mode Introduction

In the Memory directory , there should be a folder "Config" , and a config.txt file in this folder. Put different number in the txt file , the module will works in different mode as follows

Working Mode and Config Number

Mode	Mode1	Mode2	Mode3	Mode4	Mode5	Mode6	Mode7	Mode8
Config	1	2	3	4	5	6	7	8

Mode 1 : Serial Port with Key interface

Put number "1" in the config file , after power on the Module , it will work in Mode 1.

In this Mode , Module can be controlled by MCU via Serial Port or Keys connect to J2 pins.

Once Module powered ,will wait for the serial command to control playback or reocrding . Playback also can be controlled by keys connected from J2 connector.

Mode 2 : Serial Port with GPIO

Put number “2” in the config file , after power on the Module , it will work in Mode 2.

In this Mode ,The Module with Serial port same as Mode 1 , and with 8 extended GPIO.

Mode 3 : IR remote control

This mode not available for this moment.

Mode 4 : 433MHz Radio control

Put number “4” in the config file , after power on the Module , it will work in Mode 4.

Operate the module by RF remote.

Mode 5 : Timing Playback

Can set the time and make the module auto-play by 8 pins setting in J2 Connector.

Mode 6: Select Play

There are 8 pins for key connection and each key play one file.

Mode 7 : Coding playback

Select the file by 8 pins (in J2 connector) coding , and STB negative pluse trigger (about 10ms) to play the file,256 files can be triggered by 8 pins coding.

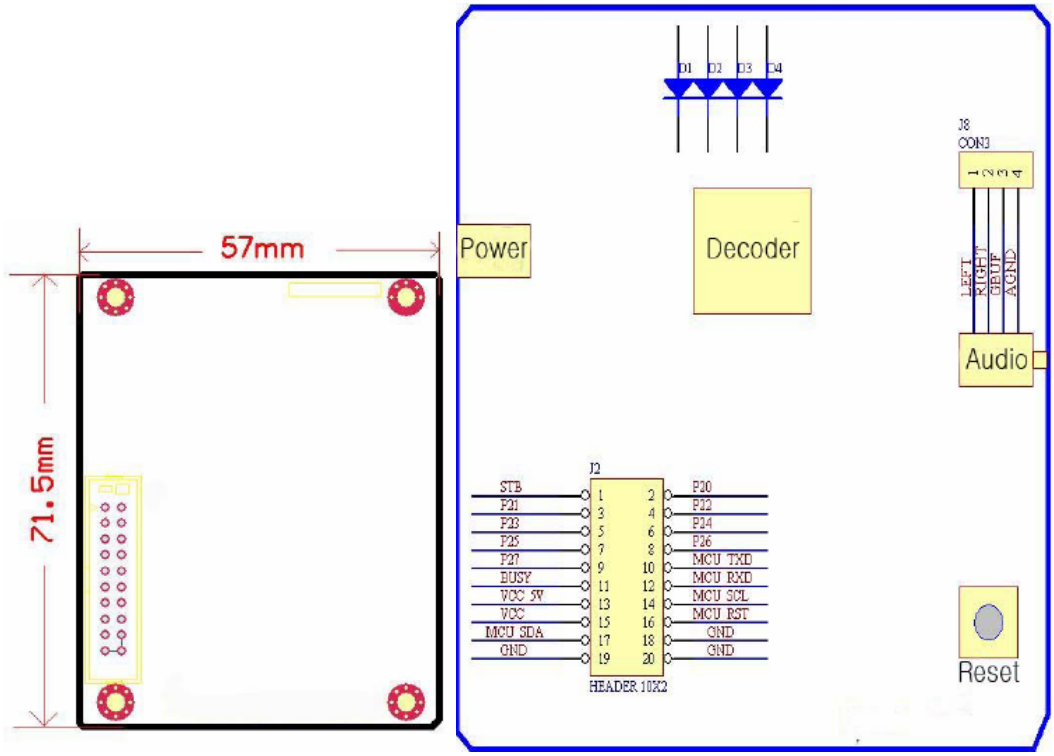
Mode 8: Auto-Play & Auto -Record

After power on, the module will detect the J5 pins , if not connected , will start to play , if connected , will start to recod . During recording ,if disconnect J5 , and will stop recording and start to play .

Mode 9 : Button Record/Play

With Record/Play switch , next ,previous , Play/Pause function by connecting buttons.

3.Structure and Pins description



3.1.Pins description

J2 Connector Pins

No.	Pin Name	Type	Function
1	STB	Input	Trigger, low active
2	P20	Input	Key input 1, GPIO 0
3	P21	Input	Key input 2, GPIO 1
4	P22	Input	Key input 3, GPIO 2
5	P23	Input	Key input 4, GPIO 3
6	P24	Input	Key input 5, GPIO 4
7	P25	Input	Key input 6, GPIO 5

8	P26	Input	Key input 7, GPIO 6
9	P27	Input	Key input 8, GPIO 7
10	MCU_TXD	Output	Serial port,TTL signal transmit
11	BUSY	Output	Busy pin, low level during playing, can pull up to 5V
12	MCU_RXD	Input	Serial port,TTL signal receive
13	VCC_5V	Power	DC 5V power,connected to J7 positive
14	MCU_SCL	Output	I2C communication, Clock pin, Recording signal switch pin
15	VCC	Power	DC 2.5V output from stabilizers
16	MCU_RST	Input	Reset
17	NC		Not Connected
18,19,20	GND	Power	Ground

J8 Connector Pins

No.	Pin Name	Type	Function
1	LEFT	Audio/Output	Audio output L
2	RIGHT	Audio/Output	Audio output R
3	GBUF	Audio/Output	Public Audio signal
4	AGND	Audio/Power	Audio Ground

3.2.LED functions on the Module

D4 : Power indicator

D1 : Memory card status indicator .After power on , this lED turn on means Memory card ready, if off , means can not read the memory card ,please check out the memory card quality and system (Should be FAT16) and the config file . When playing or recording , it will be flashing.

D2: MCU working staus indicator ,when there is trigger from outside , it will flash. This indicator work different for different Operating Mode.

D3 : BUSY indicator, when the BUSY pin is low , the LED is on , means system working,can not receive new command, When BUSY pin is High , and system free and LED off.

Module will initialize after power on ,if failure , D3 will flash 10 time then reset . If Memory card Initialization failure , D2 will flash 10 times and then reset , If file system wrong (correct should be FAT16), D1 willl flash . If config file error , D1 and D2 flash at the same time .

3.3.Files Saving in Memory Card

The Memory should format to FAT before loading files , and the Memory card should not bigger than 2GB

And there should be two folders in the Memory card , “Music” folder and “Config” folder . And in the Config folder ,should new a txt file and name it to “config.txt” and input the Mode number (from 1 to 8 for selecting different working mode .)

When the module working in Mode 6 and 7 , the files name in the Music folder should be 000.mp3 ,001.mp3 ,….256.mp3

Config file in the Memory card

There should be two folder in the SD card

In the config folder , new a txt file and rename it to config.txt

Input number (from 1 to 9)to the txt file select working Mode

4.Working Modes description

Mode 7

Put number “7” to the config file ,power on the module It will works in Mode 7, can play 256 files maximum .

After power on , if everything is ok ,LED D1 will be ON , D2 and D3 OFF .

When put low STB , Module will read the level value from P20 to P27 first , then convert the Binary value to decimal value ,and start to find the corresponding file (000*.mp3 – 256*.mp3)in the “music” folder . During this ,D2 flash one time means response for the trigger ,when the STB become Hihg ,It will start to play the coresponding file. During playing D3 (BUSY) will be ON (low level output) , after play filish, D3 will turn off .

After trigger (STB from low to high) , if LED D2 flashing , D3 always OFF , means fail to find out the coresponding file to play . Please check the file name valid or not .

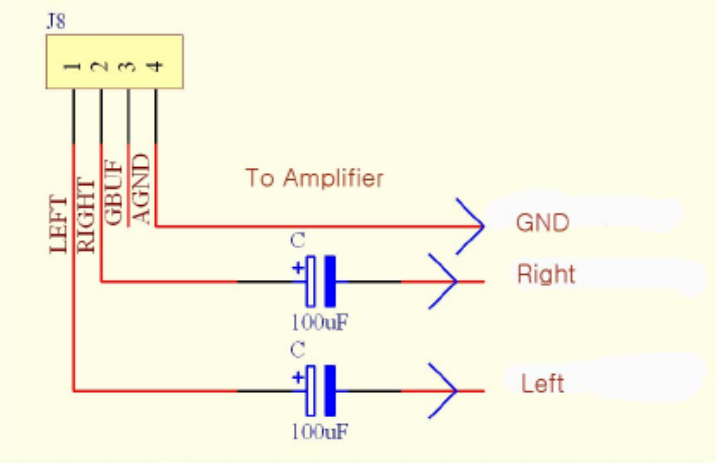
During playing , trigger STB again , will stop the playing ,and turn off D3.

The Pins P20 to P27 connected pull up resistor ,when the pin N/C , it is 0 . When connect to GND, it is 1 . P20 is lowest bit, P27 is highest bit .

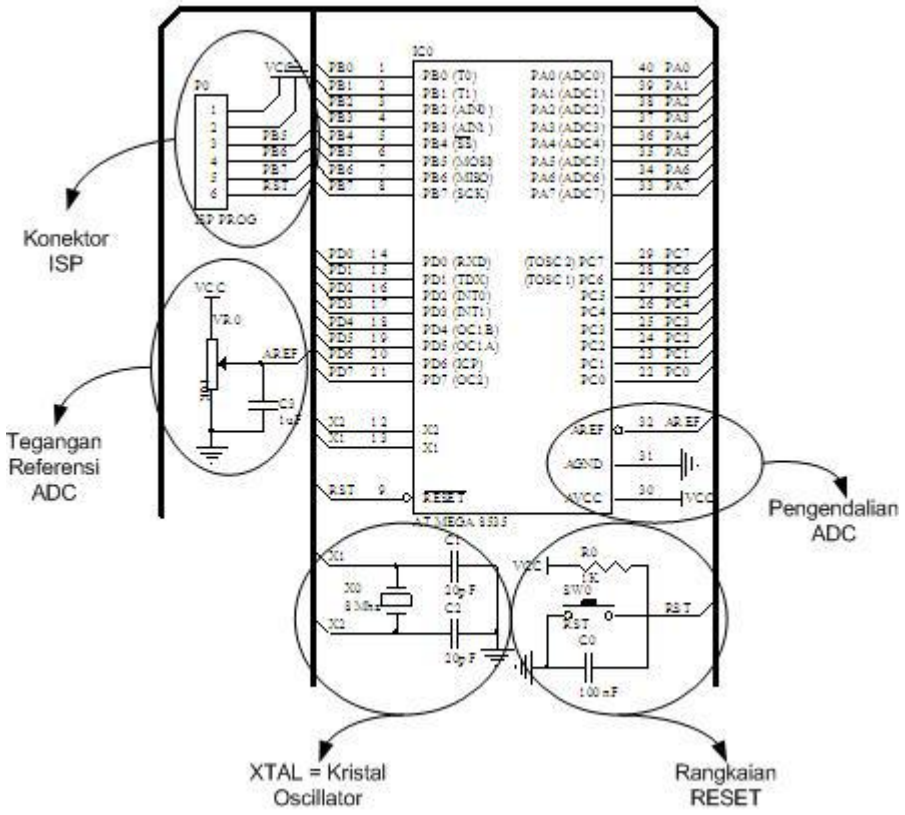
The mp3 files name in the “music” folder ,should start with numbers , for example, 001mylove.mp3 , when STB trigger and read the P20 to P27 value is 006 (Binary converted to decimal) , it will start to play this file .

When using MCU or PLC control the module , the trigger time must more than 10ms , if shorter than 10ms will not response.

5. Audio Output



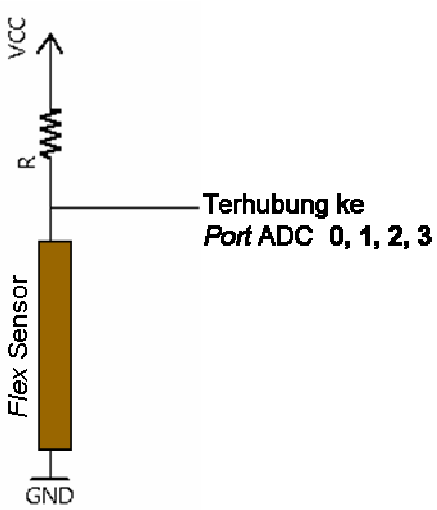
C.4 SKEMATIK KIT PENGONTROL MIKRO ATMEGA16



LAMPIRAN D

PERHITUNGAN NILAI RESISTOR YANG DIGUNAKAN SEBAGAI PEMBAGI TEGANGAN PADA *FLEX* SENSOR

D.1 Menghitung Nilai Resistor yang akan Digunakan Sebagai Pembagi Tegangan untuk *Flex* Sensor 4,5 Inci



Diketahui:
Kisaran resistansi *flex* sensor yaitu antara 10k – 40k Ohm.
Vcc = 5 Volt.
Kisaran tegangan yang diinginkan yaitu antara 3 – 4 Volt.

Dengan memperhitungkan resistor *pull-up* dari *port* ADC pada pengontrol mikro (10k Ohm), maka:

*Tegangan yang diinginkan sebesar 3 Volt pada saat *flex* sensor lurus (*flat*)

$$\frac{10k}{10k + (R \,//\, 10k)} = \frac{3}{5}$$

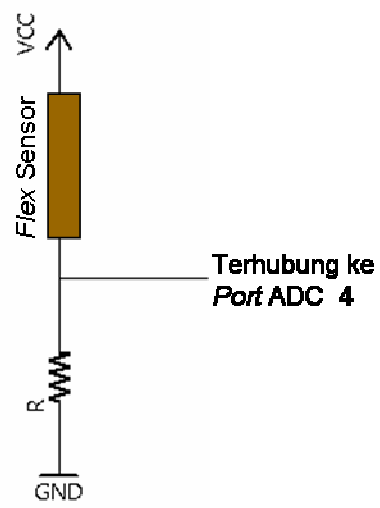
Sehingga (R // 10k) = 6,67k ; maka R = 20k Ohm.

*Tegangan yang diinginkan sebesar 4 Volt pada saat *flex* sensor ditekuk (*full*)
Jika R yang digunakan sebesar 20k Ohm, maka

$$\frac{40k}{40k + (20k \,//\, 10k)} \times 5\ Volt = 4{,}28\ Volt$$

Berdasarkan perhitungan yang telah dilakukan, dan disertai berbagai pertimbangan, maka digunakanlah resistor dengan hambatan 22k Ohm sebagai pembagi tegangan untuk *flex* sensor 4,5 inci.

D.2 Menghitung Nilai Resistor yang akan Digunakan Sebagai Pembagi Tegangan untuk *Flex* Sensor 2,2 Inci



Diketahui:

Kisaran resistansi *flex* sensor yaitu antara 20k – 60k Ohm.

Vcc = 5 Volt.

Kisaran tegangan yang diinginkan yaitu antara 3 – 4 Volt.

Dengan memperhitungkan resistor *pull-up* dari *port* ADC pada pengontrol mikro (10k Ohm), maka:

*Tegangan yang diinginkan sebesar 3 Volt pada saat *flex* sensor ditekuk (penuh)

$$\frac{R}{R + (60k \,//\, 10k)} = \frac{3}{5}$$

Sehingga R = 12,86k Ohm.

*Tegangan yang diinginkan sebesar 4 Volt pada saat *flex* sensor lurus (*flat*)

Jika R yang digunakan sebesar 12,86k Ohm, maka

$$\frac{12{,}86k}{12{,}86k + (20k \,//\, 10k)} \times 5\ \text{Volt} = 3{,}3\ \text{Volt}$$

Pembagi tegangan yang dibuat tidak memungkinkan untuk menghasilkan tegangan sebesar 4 Volt, maka digunakanlah resistor dengan hambatan 15k Ohm dengan harapan dapat memperlebar kisaran tegangan.