```
/*****************************************************
This program was produced by the
CodeWizardAVR V1.25.3 Professional
Automatic Program Generator
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Project : Program Test
Version :
Date    : 1/1/2008
Author  : Raymond
Company :
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 <delay.h>
#include <scankeypadD.h>
#include <scankeypadD_rev.h>
#include <sudutservo.h>
#include <stdio.h>
char s1=90,s2=90,s3=90,s4=90,s5=90,s6=90,s7=90,s8=90;
char bil1,bil2;
char tempc,tot;
char text[16];
eeprom char z=0;

#define delay delay_ms(10);

// Alphanumeric LCD Module functions
#asm
   .equ __lcd_port=0x15 ;PORTC
#endasm
#include <lcd.h>

// Declare your global variables here

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

// Input/Output Ports initialization
// Port A 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
PORTA=0x00;
DDRA=0xFF;

// Port B 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
PORTB=0x00;
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=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;
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// 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;

// LCD module initialization
lcd_init(16);

lcd_clear();
lcd_putsf("A - input geser B - sudut sudut");
while (1)
      {
      // Place your code here
      mulai:
      tempc=scan_keypadD_rev();
      switch(tempc)
      {
      case 'A':lcd_clear();lcd_putsf("input no motor");goto manual_geser;break;
      case 'B':lcd_clear();lcd_putsf("input no motor");goto manual_sudut;break;
      case 'C':lcd_clear();lcd_putsf("mode auto");goto auto;break;
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    case 'D':lcd_clear();lcd_putsf("gerakan hormat");goto hormat;break;
    case
'0':sudutservo(90,1);sudutservo(90,2);sudutservo(90,3);sudutservo(90,4);sudutservo(90,5);sudutservo(90,6);sudutservo(90,7);su
dutservo(90,8);;break;
    case 1:lcd_clear();lcd_putsf("jalan ke depan");goto satu;break;
    }
    goto mulai;
//=============================================sudut==================================
    manual_sudut:
    tempc=scan_keypadD_rev();
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("input sdt mtr 1 ");sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);goto
sudut1;break;
    case 2:lcd_clear();lcd_putsf("input sdt mtr 2 ");sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);goto
sudut2;break;
    case 3:lcd_clear();lcd_putsf("input sdt mtr 3 ");sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);goto
sudut3;break;
    case 4:lcd_clear();lcd_putsf("input sdt mtr 4 ");sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);goto
sudut4;break;
    case 5:lcd_clear();lcd_putsf("input sdt mtr 5 ");sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);goto
sudut5;break;
    case 6:lcd_clear();lcd_putsf("input sdt mtr 6 ");sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);goto
sudut6;break;
    case 7:lcd_clear();lcd_putsf("input sdt mtr 7 ");sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);goto
sudut7;break;
    case 8:lcd_clear();lcd_putsf("input sdt mtr 8 ");sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);goto
sudut8;break;
    case 'D':goto mulai;break;
    }
    goto manual_sudut;
//=============================================sudut1=================================
    sudut1:
    tempc=scan_keypadD_rev();
    switch(tempc)
    {
    case '0':bil2=bil1;bil1=0;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 1:bil2=bil1;bil1=1;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 2:bil2=bil1;bil1=2;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 3:bil2=bil1;bil1=3;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 4:bil2=bil1;bil1=4;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 5:bil2=bil1;bil1=5;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 6:bil2=bil1;bil1=6;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 7:bil2=bil1;bil1=7;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 8:bil2=bil1;bil1=8;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 9:bil2=bil1;bil1=9;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case '*':tempc=90-tot;sudutservo(tempc,1);break;
    case '#':tempc=90+tot;sudutservo(tempc,1);break;
    case 'A':bil1=0;bil2=0;tot=0;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(90,1);break;
    case 'C':lcd_clear();lcd_putsf("input no motor");goto manual_sudut;break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto sudut1;
//=============================================sudut2=================================
    sudut2:
    tempc=scan_keypadD_rev();
    switch(tempc)
    {
    case '0':bil2=bil1;bil1=0;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 1:bil2=bil1;bil1=1;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 2:bil2=bil1;bil1=2;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 3:bil2=bil1;bil1=3;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 4:bil2=bil1;bil1=4;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 5:bil2=bil1;bil1=5;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 6:bil2=bil1;bil1=6;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 7:bil2=bil1;bil1=7;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 8:bil2=bil1;bil1=8;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 9:bil2=bil1;bil1=9;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case '*':tempc=90-tot;sudutservo(tempc,2);break;
    case '#':tempc=90+tot;sudutservo(tempc,2);break;
    case 'A':bil1=0;bil2=0;tot=0;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(90,2);break;
    case 'C':lcd_clear();lcd_putsf("input no motor");goto manual_sudut;break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
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    }
    goto sudut2;
//=============================================sudut3=================================
    sudut3:
    tempc=scan_keypadD_rev();
    switch(tempc)
    {
    case '0':bil2=bil1;bil1=0;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 1:bil2=bil1;bil1=1;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 2:bil2=bil1;bil1=2;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 3:bil2=bil1;bil1=3;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 4:bil2=bil1;bil1=4;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 5:bil2=bil1;bil1=5;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 6:bil2=bil1;bil1=6;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 7:bil2=bil1;bil1=7;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 8:bil2=bil1;bil1=8;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 9:bil2=bil1;bil1=9;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case '*':tempc=90-tot;sudutservo(tempc,3);break;
    case '#':tempc=90+tot;sudutservo(tempc,3);break;
    case 'A':bil1=0;bil2=0;tot=0;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(90,3);break;
    case 'C':lcd_clear();lcd_putsf("input no motor");goto manual_sudut;break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto sudut3;
//=============================================sudut4=================================
    sudut4:
    tempc=scan_keypadD_rev();
    switch(tempc)
    {
    case '0':bil2=bil1;bil1=0;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 1:bil2=bil1;bil1=1;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 2:bil2=bil1;bil1=2;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 3:bil2=bil1;bil1=3;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 4:bil2=bil1;bil1=4;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 5:bil2=bil1;bil1=5;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 6:bil2=bil1;bil1=6;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 7:bil2=bil1;bil1=7;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 8:bil2=bil1;bil1=8;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 9:bil2=bil1;bil1=9;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case '*':tempc=90-tot;sudutservo(tempc,4);break;
    case '#':tempc=90+tot;sudutservo(tempc,4);break;
    case 'A':bil1=0;bil2=0;tot=0;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(90,4);break;
    case 'C':lcd_clear();lcd_putsf("input no motor");goto manual_sudut;break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;
    goto sudut4;
//=============================================sudut5=================================
    sudut5:
    tempc=scan_keypadD_rev();
    switch(tempc)
    {
    case '0':bil2=bil1;bil1=0;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 1:bil2=bil1;bil1=1;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 2:bil2=bil1;bil1=2;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 3:bil2=bil1;bil1=3;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 4:bil2=bil1;bil1=4;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 5:bil2=bil1;bil1=5;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 6:bil2=bil1;bil1=6;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 7:bil2=bil1;bil1=7;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 8:bil2=bil1;bil1=8;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 9:bil2=bil1;bil1=9;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case '*':tempc=90-tot;sudutservo(tempc,5);break;
    case '#':tempc=90+tot;sudutservo(tempc,5);break;
    case 'A':bil1=0;bil2=0;tot=0;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(90,5);break;
    case 'C':lcd_clear();lcd_putsf("input no motor");goto manual_sudut;break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto sudut5;
//=============================================sudut6=================================
    sudut6:
    tempc=scan_keypadD_rev();
    switch(tempc)
    {
    case '0':bil2=bil1;bil1=0;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
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    case 1:bil2=bil1;bil1=1;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 2:bil2=bil1;bil1=2;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 3:bil2=bil1;bil1=3;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 4:bil2=bil1;bil1=4;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 5:bil2=bil1;bil1=5;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 6:bil2=bil1;bil1=6;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 7:bil2=bil1;bil1=7;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 8:bil2=bil1;bil1=8;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 9:bil2=bil1;bil1=9;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case '*':tempc=90-tot;sudutservo(tempc,6);break;
    case '#':tempc=90+tot;sudutservo(tempc,6);break;
    case 'A':bil1=0;bil2=0;tot=0;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(90,6);break;
    case 'C':lcd_clear();lcd_putsf("input no motor");goto manual_sudut;break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto sudut6;
//================================================sudut7=================================
    sudut7:
    tempc=scan_keypadD_rev();
    switch(tempc)
    {
    case '0':bil2=bil1;bil1=0;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 1:bil2=bil1;bil1=1;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 2:bil2=bil1;bil1=2;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 3:bil2=bil1;bil1=3;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 4:bil2=bil1;bil1=4;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 5:bil2=bil1;bil1=5;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 6:bil2=bil1;bil1=6;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 7:bil2=bil1;bil1=7;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 8:bil2=bil1;bil1=8;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 9:bil2=bil1;bil1=9;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case '*':tempc=90-tot;sudutservo(tempc,7);break;
    case '#':tempc=90+tot;sudutservo(tempc,7);break;
    case 'A':bil1=0;bil2=0;tot=0;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(90,7);break;
    case 'C':lcd_clear();lcd_putsf("input no motor");goto manual_sudut;break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto sudut7;
//================================================sudut8=================================
    sudut8:
    tempc=scan_keypadD_rev();
    switch(tempc)
    {
    case '0':bil2=bil1;bil1=0;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 1:bil2=bil1;bil1=1;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 2:bil2=bil1;bil1=2;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 3:bil2=bil1;bil1=3;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 4:bil2=bil1;bil1=4;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 5:bil2=bil1;bil1=5;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 6:bil2=bil1;bil1=6;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 7:bil2=bil1;bil1=7;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 8:bil2=bil1;bil1=8;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case 9:bil2=bil1;bil1=9;tot=bil2*10+bil1;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);break;
    case '*':tempc=90-tot;sudutservo(tempc,8);break;
    case '#':tempc=90+tot;sudutservo(tempc,8);break;
    case 'A':bil1=0;bil2=0;tot=0;sprintf(text,"sudut %2d",tot);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(90,8);break;
    case 'C':lcd_clear();lcd_putsf("input no motor");goto manual_sudut;break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto sudut8;
//=========================================manual==================
    manual_geser:
    tempc=scan_keypadD();
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("motor servo 1");sprintf(text,"sudut servo1 %3d",s1);lcd_gotoxy(0,1);lcd_puts(text);goto
servo1;break;
    case 2:lcd_clear();lcd_putsf("motor servo 2");sprintf(text,"sudut servo2 %3d",s2);lcd_gotoxy(0,1);lcd_puts(text);goto
servo2;break;
    case 3:lcd_clear();lcd_putsf("motor servo 3");sprintf(text,"sudut servo3 %3d",s3);lcd_gotoxy(0,1);lcd_puts(text);goto
servo3;break;
    case 4:lcd_clear();lcd_putsf("motor servo 4");sprintf(text,"sudut servo4 %3d",s4);lcd_gotoxy(0,1);lcd_puts(text);goto
servo4;break;
```

```
    case 5:lcd_clear();lcd_putsf("motor servo 5");sprintf(text,"sudut servo5 %3d",s5);lcd_gotoxy(0,1);lcd_puts(text);goto
servo5;break;
    case 6:lcd_clear();lcd_putsf("motor servo 6");sprintf(text,"sudut servo6 %3d",s6);lcd_gotoxy(0,1);lcd_puts(text);goto
servo6;break;
    case 7:lcd_clear();lcd_putsf("motor servo 7");sprintf(text,"sudut servo7 %3d",s7);lcd_gotoxy(0,1);lcd_puts(text);goto
servo7;break;
    case 8:lcd_clear();lcd_putsf("motor servo 8");sprintf(text,"sudut servo8 %3d",s8);lcd_gotoxy(0,1);lcd_puts(text);goto
servo8;break;
    }
    goto manual_geser;
//=====================================motor 1=========================
    servo1:
    tempc=scan_keypadD();
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("motor servo 1");goto servo1;break;
    case 2:lcd_clear();lcd_putsf("motor servo 2");goto servo2;break;
    case 3:lcd_clear();lcd_putsf("motor servo 3");goto servo3;break;
    case 4:lcd_clear();lcd_putsf("motor servo 4");goto servo4;break;
    case 5:lcd_clear();lcd_putsf("motor servo 5");goto servo5;break;
    case 6:lcd_clear();lcd_putsf("motor servo 6");goto servo6;break;
    case 7:lcd_clear();lcd_putsf("motor servo 7");goto servo7;break;
    case 8:lcd_clear();lcd_putsf("motor servo 8");goto servo8;break;
    case '*':s1--;delay_ms(50);sprintf(text,"sudut servo1 %3d",s1);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s1,1);break;
    case '#':s1++;delay_ms(50);sprintf(text,"sudut servo1 %3d",s1);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s1,1);break;
    case 'A':s1=90;delay_ms(50);sprintf(text,"sudut servo1 %3d",s1);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s1,1);break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto servo1;
//=====================================motor 2=========================
    servo2:
    tempc=scan_keypadD();
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("motor servo 1");goto servo1;break;
    case 2:lcd_clear();lcd_putsf("motor servo 2");goto servo2;break;
    case 3:lcd_clear();lcd_putsf("motor servo 3");goto servo3;break;
    case 4:lcd_clear();lcd_putsf("motor servo 4");goto servo4;break;
    case 5:lcd_clear();lcd_putsf("motor servo 5");goto servo5;break;
    case 6:lcd_clear();lcd_putsf("motor servo 6");goto servo6;break;
    case 7:lcd_clear();lcd_putsf("motor servo 7");goto servo7;break;
    case 8:lcd_clear();lcd_putsf("motor servo 8");goto servo8;break;
    case '*':s2--;delay_ms(50);sprintf(text,"sudut servo2 %3d",s2);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s2,2);break;
    case '#':s2++;delay_ms(50);sprintf(text,"sudut servo2 %3d",s2);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s2,2);break;
    case 'A':s2=90;delay_ms(50);sprintf(text,"sudut servo2 %3d",s2);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s2,2);break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto servo2;
//=====================================motor 3=========================
    servo3:
    tempc=scan_keypadD();
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("motor servo 1");goto servo1;break;
    case 2:lcd_clear();lcd_putsf("motor servo 2");goto servo2;break;
    case 3:lcd_clear();lcd_putsf("motor servo 3");goto servo3;break;
    case 4:lcd_clear();lcd_putsf("motor servo 4");goto servo4;break;
    case 5:lcd_clear();lcd_putsf("motor servo 5");goto servo5;break;
    case 6:lcd_clear();lcd_putsf("motor servo 6");goto servo6;break;
    case 7:lcd_clear();lcd_putsf("motor servo 7");goto servo7;break;
    case 8:lcd_clear();lcd_putsf("motor servo 8");goto servo8;break;
    case '*':s3--;delay_ms(100);sprintf(text,"sudut servo3 %3d",s3);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s3,3);break;
    case '#':s3++;delay_ms(100);sprintf(text,"sudut servo3 %3d",s3);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s3,3);break;
    case 'A':s3=90;delay_ms(100);sprintf(text,"sudut servo3 %3d",s3);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s3,3);break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto servo3;
//=====================================motor 4=========================
    servo4:
    tempc=scan_keypadD();
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("motor servo 1");goto servo1;break;
```

```
    case 2:lcd_clear();lcd_putsf("motor servo 2");goto servo2;break;
    case 3:lcd_clear();lcd_putsf("motor servo 3");goto servo3;break;
    case 4:lcd_clear();lcd_putsf("motor servo 4");goto servo4;break;
    case 5:lcd_clear();lcd_putsf("motor servo 5");goto servo5;break;
    case 6:lcd_clear();lcd_putsf("motor servo 6");goto servo6;break;
    case 7:lcd_clear();lcd_putsf("motor servo 7");goto servo7;break;
    case 8:lcd_clear();lcd_putsf("motor servo 8");goto servo8;break;
    case '*':s4--;delay_ms(50);sprintf(text,"sudut servo4 %3d",s4);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s4,4);break;
    case '#':s4++;delay_ms(50);sprintf(text,"sudut servo4 %3d",s4);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s4,4);break;
    case 'A':s4=90;delay_ms(50);sprintf(text,"sudut servo4 %3d",s4);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s4,4);break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto servo4;
//=======================================motor 5=========================
    servo5:
    tempc=scan_keypadD();
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("motor servo 1");goto servo1;break;
    case 2:lcd_clear();lcd_putsf("motor servo 2");goto servo2;break;
    case 3:lcd_clear();lcd_putsf("motor servo 3");goto servo3;break;
    case 4:lcd_clear();lcd_putsf("motor servo 4");goto servo4;break;
    case 5:lcd_clear();lcd_putsf("motor servo 5");goto servo5;break;
    case 6:lcd_clear();lcd_putsf("motor servo 6");goto servo6;break;
    case 7:lcd_clear();lcd_putsf("motor servo 7");goto servo7;break;
    case 8:lcd_clear();lcd_putsf("motor servo 8");goto servo8;break;
    case '*':s5--;delay_ms(50);sprintf(text,"sudut servo5 %3d",s5);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s5,5);break;
    case '#':s5++;delay_ms(50);sprintf(text,"sudut servo5 %3d",s5);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s5,5);break;
    case 'A':s5=90;delay_ms(50);sprintf(text,"sudut servo5 %3d",s5);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s5,5);break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto servo5;
//=======================================motor 6=========================
    servo6:
    tempc=scan_keypadD();
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("motor servo 1");goto servo1;break;
    case 2:lcd_clear();lcd_putsf("motor servo 2");goto servo2;break;
    case 3:lcd_clear();lcd_putsf("motor servo 3");goto servo3;break;
    case 4:lcd_clear();lcd_putsf("motor servo 4");goto servo4;break;
    case 5:lcd_clear();lcd_putsf("motor servo 5");goto servo5;break;
    case 6:lcd_clear();lcd_putsf("motor servo 6");goto servo6;break;
    case 7:lcd_clear();lcd_putsf("motor servo 7");goto servo7;break;
    case 8:lcd_clear();lcd_putsf("motor servo 8");goto servo8;break;
    case '*':s6--;delay_ms(50);sprintf(text,"sudut servo6 %3d",s6);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s6,6);break;
    case '#':s6++;delay_ms(50);sprintf(text,"sudut servo6 %3d",s6);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s6,6);break;
    case 'A':s6=90;delay_ms(50);sprintf(text,"sudut servo6 %3d",s6);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s6,6);break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto servo6;
//=======================================motor 7=========================
    servo7:
    tempc=scan_keypadD();
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("motor servo 1");goto servo1;break;
    case 2:lcd_clear();lcd_putsf("motor servo 2");goto servo2;break;
    case 3:lcd_clear();lcd_putsf("motor servo 3");goto servo3;break;
    case 4:lcd_clear();lcd_putsf("motor servo 4");goto servo4;break;
    case 5:lcd_clear();lcd_putsf("motor servo 5");goto servo5;break;
    case 6:lcd_clear();lcd_putsf("motor servo 6");goto servo6;break;
    case 7:lcd_clear();lcd_putsf("motor servo 7");goto servo7;break;
    case 8:lcd_clear();lcd_putsf("motor servo 8");goto servo8;break;
    case '*':s7--;delay_ms(50);sprintf(text,"sudut servo7 %3d",s7);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s7,7);break;
    case '#':s7++;delay_ms(50);sprintf(text,"sudut servo7 %3d",s7);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s7,7);break;
    case 'A':s7=90;delay_ms(50);sprintf(text,"sudut servo7 %3d",s7);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s7,7);break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto servo7;
//=======================================motor 8=========================
    servo8:
    tempc=scan_keypadD();
```

```
    switch(tempc)
    {
    case 1:lcd_clear();lcd_putsf("motor servo 1");goto servo1;break;
    case 2:lcd_clear();lcd_putsf("motor servo 2");goto servo2;break;
    case 3:lcd_clear();lcd_putsf("motor servo 3");goto servo3;break;
    case 4:lcd_clear();lcd_putsf("motor servo 4");goto servo4;break;
    case 5:lcd_clear();lcd_putsf("motor servo 5");goto servo5;break;
    case 6:lcd_clear();lcd_putsf("motor servo 6");goto servo6;break;
    case 7:lcd_clear();lcd_putsf("motor servo 7");goto servo7;break;
    case 8:lcd_clear();lcd_putsf("motor servo 8");goto servo8;break;
    case '*':s8--;delay_ms(50);sprintf(text,"sudut servo8 %3d",s8);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s8,8);break;
    case '#':s8++;delay_ms(50);sprintf(text,"sudut servo8 %3d",s8);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s8,8);break;
    case 'A':s8=90;delay_ms(50);sprintf(text,"sudut servo8 %3d",s8);lcd_gotoxy(0,1);lcd_puts(text);sudutservo(s8,8);break;
    case 'D':lcd_clear();lcd_putsf("A - input geser B - sudut sudut");goto mulai;break;
    }
    goto servo8;
    };
}


void sudutservo(char sudut, char servo)
{
char bil1,bil2;

bil1=sudut&0x0f;
bil2=sudut&0xf0;bil2=bil2/16;

switch(servo)
{
case 1: PORTB=4;
       PORTA=bil1|0b00010000;delay_ms(15);
       PORTA=bil2|0b00100000;delay_ms(15);break;
case 2: PORTB=4;
              PORTA=bil1|0b00110000;delay_ms(15);
              PORTA=bil2|0b01000000;delay_ms(15);break;
case 3: PORTB=5;
              PORTA=bil1|0b00010000;delay_ms(15);
              PORTA=bil2|0b00100000;delay_ms(15);break;
case 4: PORTB=5;
              PORTA=bil1|0b00110000;delay_ms(15);
              PORTA=bil2|0b01000000;delay_ms(15);break;

case 5: PORTB=6;
              PORTA=bil1|0b00010000;delay_ms(15);
              PORTA=bil2|0b00100000;delay_ms(15);break;
case 6: PORTB=6;
              PORTA=bil1|0b00110000;delay_ms(15);
              PORTA=bil2|0b01000000;delay_ms(15);break;
case 7: PORTB=7;
              PORTA=bil1|0b00010000;delay_ms(15);
              PORTA=bil2|0b00100000;delay_ms(15);break;
case 8: PORTB=7;
              PORTA=bil1|0b00110000;delay_ms(15);
              PORTA=bil2|0b01000000;delay_ms(15);break;
}
PORTB=0;PORTA=0;
return;
}


  char scan_keypadD(void)
     {
int scankey;
char keypressed =0;
DDRD = 0x0F;
PORTD = 0xFE;
scankey = PIND&0xf0;
switch (scankey)
   {
    case 0xE0 : keypressed = 1;
    break;
    case 0xD0 : keypressed = 2;
    break;
```

```
    case 0xB0 : keypressed = 3;
    break;
    case 0x70 : keypressed = 'A';
    break;
    }
    PORTD = 0xFD;
    delay_ms(10);
scankey = PIND&0xf0;
switch (scankey)
   {
    case 0xE0 : keypressed = 4;
    break;
    case 0xD0 : keypressed = 5;
    break;
    case 0xB0 : keypressed = 6;
    break;
    case 0x70 : keypressed = 'B';
    break;
    }
    PORTD = 0xFB;
    delay_ms(10);
    scankey = PIND&0xf0;
switch (scankey)
   {
    case 0xE0 : keypressed = 7;
    break;
    case 0xD0 : keypressed = 8;
    break;
    case 0xB0 : keypressed = 9;
    break;
    case 0x70 : keypressed = 'C';
    break;
    }
    PORTD = 0xF7;
    delay_ms(10);
    scankey = PIND&0xf0;
switch (scankey)
   {
    case 0xE0 : keypressed = '*';
    break;
    case 0xD0 : keypressed = '0';
    break;
    case 0xB0 : keypressed = '#';
    break;
    case 0x70 : keypressed = 'D';
    break;
    }
      return keypressed;
       }


  char scan_keypadD_rev(void)
     {
int scankey;
char keypressed=0;
char temp;
temp=PORTD;

DDRD = 0x0F;
PORTD = 0xFE;
delay_us(1);
scankey = PIND&0xf0;
switch (scankey)
   {
    case 0xE0 : keypressed = 1; break;
    case 0xD0 : keypressed = 2; break;
    case 0xB0 : keypressed = 3; break;
    case 0x70 : keypressed = 'A'; break;
    }
cek1:
scankey = PIND&0xf0; delay_us(1);
switch (scankey)
{
```

```
case 0xf0: goto lanjut2;
default: goto cek1;
}
lanjut2:

   PORTD = 0xFD;
   delay_us(1);
scankey = PIND&0xf0;
switch (scankey)
  {
   case 0xE0 : keypressed = 4; break;
   case 0xD0 : keypressed = 5; break;
   case 0xB0 : keypressed = 6; break;
   case 0x70 : keypressed = 'B'; break;
   }
cek2:
scankey = PIND&0xf0; delay_us(1);
switch (scankey)
{
case 0xf0: goto lanjut3;
default: goto cek2;
}
lanjut3:

   PORTD = 0xFB;
   delay_us(1);
   scankey = PIND&0xf0;
switch (scankey)
  {
   case 0xE0 : keypressed = 7; break;
   case 0xD0 : keypressed = 8; break;
   case 0xB0 : keypressed = 9; break;
   case 0x70 : keypressed = 'C'; break;
   }
cek3:
scankey = PIND&0xf0; delay_us(1);
switch (scankey)
{
case 0xf0: goto lanjut4;
default: goto cek3;
}
lanjut4:

   PORTD = 0xF7;
   delay_us(1);
   scankey = PIND&0xf0;
switch (scankey)
  {
   case 0xE0 : keypressed = '*'; break;
   case 0xD0 : keypressed = '0'; break;
   case 0xB0 : keypressed = '#'; break;
   case 0x70 : keypressed = 'D'; break;
   }

cek4:
scankey = PIND&0xf0; delay_us(1);
switch (scankey)
{
case 0xf0: goto lanjut5;
default: goto cek4;
}
lanjut5:

PORTD=temp;

      return keypressed;
       }
```

```
/*****************************************************
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Project : 5 Gerakan Kaki
Version :
Date    : 1/1/2008
Author  : Raymond
Company :
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 <delay.h>
#include <sudutservo.h>

char s1=90,s2=90,s3=90,s4=90,s5=90,s6=90,s7=90,s8=90;
char bil1,bil2,tempc,tot,i;
#define delay delay_ms(100);
#define delay1 delay_ms(1000);
// Alphanumeric LCD Module functions
#asm
   .equ __lcd_port=0x15 ;PORTC
#endasm
#include <lcd.h>
// Declare your global variables here
//============================================================
void kanan_naik(void)
{//kaki kanan angkat
sudutservo(100,2);delay;
sudutservo(110,2);delay;
sudutservo(100,7);delay;
sudutservo(110,7);delay;
sudutservo(120,7);delay;
sudutservo(130,7);delay;
sudutservo(140,7);delay;
sudutservo(120,2);delay;
sudutservo(150,7);delay;
sudutservo(130,2);delay;
sudutservo(160,7);delay;
sudutservo(135,2);delay;
sudutservo(150,7);delay;
sudutservo(140,7);delay;
sudutservo(130,7);delay;
sudutservo(120,7);delay;
sudutservo(110,7);delay;
sudutservo(100,7);delay;
sudutservo(90,7);delay;delay;
return;
}
//============================================================
void kanan_maju(void)
{//==kaki kanan maju - kaki kiri mundur==
sudutservo(90,3);sudutservo(90,4);sudutservo(90,6);sudutservo(90,5);delay;
sudutservo(95,3);sudutservo(95,4);sudutservo(95,6);sudutservo(95,5);delay;
sudutservo(100,3);sudutservo(100,4);sudutservo(100,6);sudutservo(100,5);delay;
sudutservo(105,3);sudutservo(105,4);sudutservo(105,6);sudutservo(105,5);delay;
sudutservo(110,3);sudutservo(110,4);sudutservo(110,6);sudutservo(110,5);delay;
sudutservo(115,3);sudutservo(115,4);sudutservo(115,6);sudutservo(115,5);delay;
return;
}
//============================================================
 void kanan_turun(void)
```

```
 {//==kaki kanan turun==
sudutservo(130,2);delay;delay;
sudutservo(120,2);delay;delay;
sudutservo(110,2);delay;delay;
sudutservo(100,2);delay;delay;
sudutservo(90,2);delay;delay;
return;
}
//============================================================
void kiri_naik(void)
{//==kaki kiri naik==
sudutservo(80,7);delay;
sudutservo(70,7);delay;
sudutservo(80,2);delay;
sudutservo(70,2);delay;
sudutservo(60,2);delay;
sudutservo(50,2);delay;
sudutservo(40,2);delay;
sudutservo(60,7);delay;
sudutservo(30,2);delay;
sudutservo(50,7);delay;
sudutservo(20,2);delay;
sudutservo(45,7);delay;
sudutservo(30,2);delay;
sudutservo(40,2);delay;
sudutservo(50,2);delay;
sudutservo(60,2);delay;
sudutservo(70,2);delay;
sudutservo(80,2);delay;
sudutservo(90,2);delay;delay;
return;
}
//============================================================
void kiri_maju(void)
{//==kaki kiri maju - kaki kanan mundur==
sudutservo(90,6);sudutservo(90,5);sudutservo(90,3);sudutservo(90,4);delay;
sudutservo(85,6);sudutservo(85,5);sudutservo(85,3);sudutservo(85,4);delay;
sudutservo(80,6);sudutservo(80,5);sudutservo(80,3);sudutservo(80,4);delay;
sudutservo(75,6);sudutservo(75,5);sudutservo(75,3);sudutservo(75,4);delay;
sudutservo(70,6);sudutservo(70,5);sudutservo(70,3);sudutservo(70,4);delay;
sudutservo(65,6);sudutservo(65,5);sudutservo(65,3);sudutservo(65,4);delay;
return;
}
//============================================================
void kiri_turun(void)
{//==kaki kiri turun==
sudutservo(50,7);delay;delay;
sudutservo(60,7);delay;delay;
sudutservo(70,7);delay;delay;
sudutservo(80,7);delay;delay;
sudutservo(90,7);delay;delay;
return;
}
//============================================================
void lurus(void)
{//==kaki kanan - kaki kiri lurus
sudutservo(90,3);sudutservo(90,4);sudutservo(90,6);sudutservo(90,5);delay;delay;
return;
}
//============================================================
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=0x00;
DDRA=0xff;

// 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=T State2=T State1=T State0=T
```

```
PORTB=0x00;
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=0x00;
DDRC=0x00;

// 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;
// LCD module initialization
```

```
lcd_init(16);
lcd_clear();

while (1)
    { // Place your code here
satu:
delay1;
kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;

kanan_naik();delay1;
kiri_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kanan_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();
kanan_turun();delay1;
//=======================================dua==============================
dua:
delay_ms(1000);
kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;

kanan_naik();delay1;
for(i=90;i<121;i=i+1)
{sudutservo(i,1);delay_ms(50);}
delay1;
kanan_turun();delay1;
kiri_naik();delay1;
for(i=120;i>89;i=i-1)
{sudutservo(i,1);delay_ms(50);}
delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;
```

```
kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;
//=====================================tiga============================
tiga:
delay_ms(1000);
kanan_naik();delay1;
kiri_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kanan_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kiri_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kanan_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;

kiri_naik();delay1;
for(i=90;i>44;i=i-5)
{sudutservo(i,8);delay_ms(50);}
delay1;
kiri_turun();delay1;

kanan_naik();delay1;
for(i=45;i<91;i=i+5)
{sudutservo(i,8); }
delay1;
kanan_turun();delay1;

kanan_naik();delay1;
kiri_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kanan_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kiri_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kanan_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;
//=====================================empat============================
empat:
delay_ms(1000);
kiri_naik();delay1;
for(i=90;i>44;i=i-5)
{sudutservo(i,8);delay_ms(50);}
delay1;
kiri_turun();delay1;

kanan_naik();delay1;
for(i=45;i<91;i=i+5)
{sudutservo(i,8);delay_ms(50);}
```

```
delay1;
kanan_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;

kanan_naik();delay1;
for(i=90;i<136;i=i+5)
{sudutservo(i,1);delay_ms(50);}
delay1;
kanan_turun();delay1;

kiri_naik();delay1;
for(i=135;i>89;i=i-5)
{sudutservo(i,1);delay_ms(50);}
delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;
//=======================================lima============================
lima:
delay_ms(1000);
kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;

kanan_naik();delay1;
for(i=90;i<181;i=i+5)
{sudutservo(i,1);delay_ms(50);}
delay1;
kanan_turun();delay1;

kiri_naik();delay1;
for(i=180;i>89;i=i-5)
{sudutservo(i,1);delay_ms(50);}
```

```
delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;

kanan_naik();delay1;
for(i=90;i<181;i=i+5)
{sudutservo(i,1);delay_ms(50);}
delay1;
kanan_turun();delay1;

kiri_naik();delay1;
for(i=180;i>89;i=i-5)
{sudutservo(i,1);delay_ms(50);}
delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;

kanan_naik();delay1;
for(i=90;i<181;i=i+5)
{sudutservo(i,1);delay_ms(50);}
delay1;
kanan_turun();delay1;

kiri_naik();delay1;
for(i=180;i>89;i=i-5)
{sudutservo(i,1);delay_ms(50);}
delay1;
kiri_turun();delay1;

kanan_naik();delay1;
kanan_maju();delay1;
kanan_turun();delay1;
kiri_naik();delay1;
kiri_maju();delay1;
kiri_turun();delay1;

kanan_naik();delay1;
lurus();delay1;
kanan_turun();delay1;

kanan_naik();delay1;
for(i=90;i<181;i=i+5)
{sudutservo(i,1);delay_ms(50);}
delay1;
kanan_turun();delay1;

kiri_naik();delay1;
for(i=180;i>89;i=i-5)
{sudutservo(i,1);delay_ms(50);}
delay1;
kiri_turun();delay1;
};
}
```

Features

- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions – Most Single-clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16 MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory segments
  - 16K Bytes of In-System Self-programmable Flash program memory
  - 512 Bytes EEPROM
  - 1K Byte Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C(1)
  - Optional Boot Code Section with Independent Lock Bits
    In-System Programming by On-chip Boot Program
    True Read-While-Write Operation
  - Programming Lock for Software Security
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Four PWM Channels
  - 8-channel, 10-bit ADC
    - 8 Single-ended Channels
    - 7 Differential Channels in TQFP Package Only
    - 2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - Byte-oriented Two-wire Serial Interface
  - Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- I/O and Packages
  - 32 Programmable I/O Lines
  - 40-pin PDIP, 44-lead TQFP, and 44-pad QFN/MLF
- Operating Voltages
  - 2.7 - 5.5V for ATmega16L
  - 4.5 - 5.5V for ATmega16
- Speed Grades
  - 0 - 8 MHz for ATmega16L
  - 0 - 16 MHz for ATmega16
- Power Consumption @ 1 MHz, 3V, and 25°C for ATmega16L
  - Active: 1.1 mA
  - Idle Mode: 0.35 mA
  - Power-down Mode: < 1 µA

8-bit AVR® Microcontroller with 16K Bytes In-System Programmable Flash

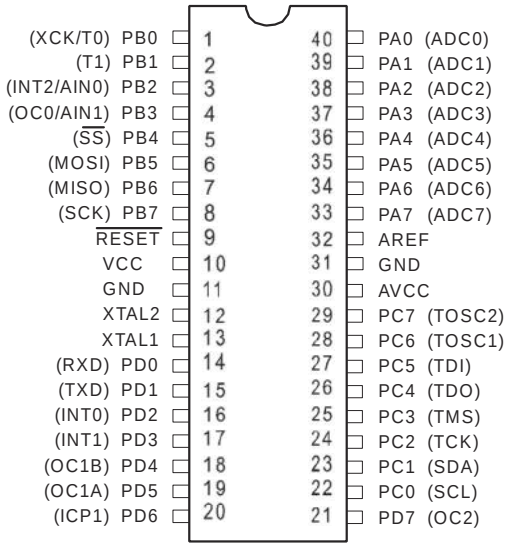
ATmega16
ATmega16L

Summary

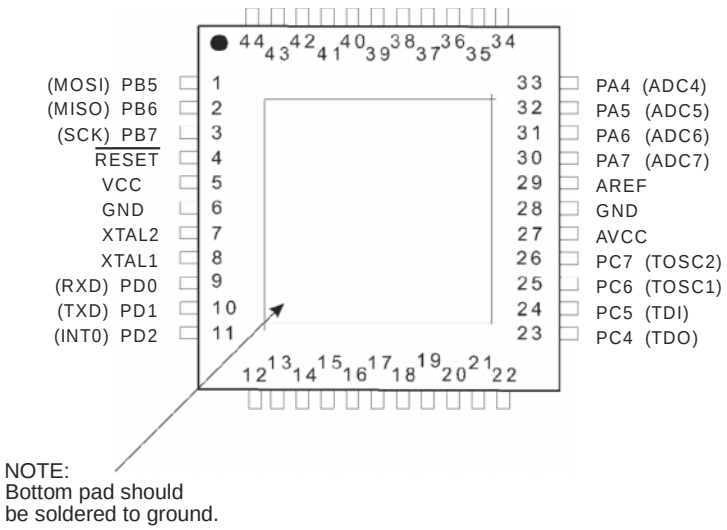
Pin Configurations

Figure 1. Pinout ATmega16

PDIP



TQFP/QFN/MLF



Disclaimer

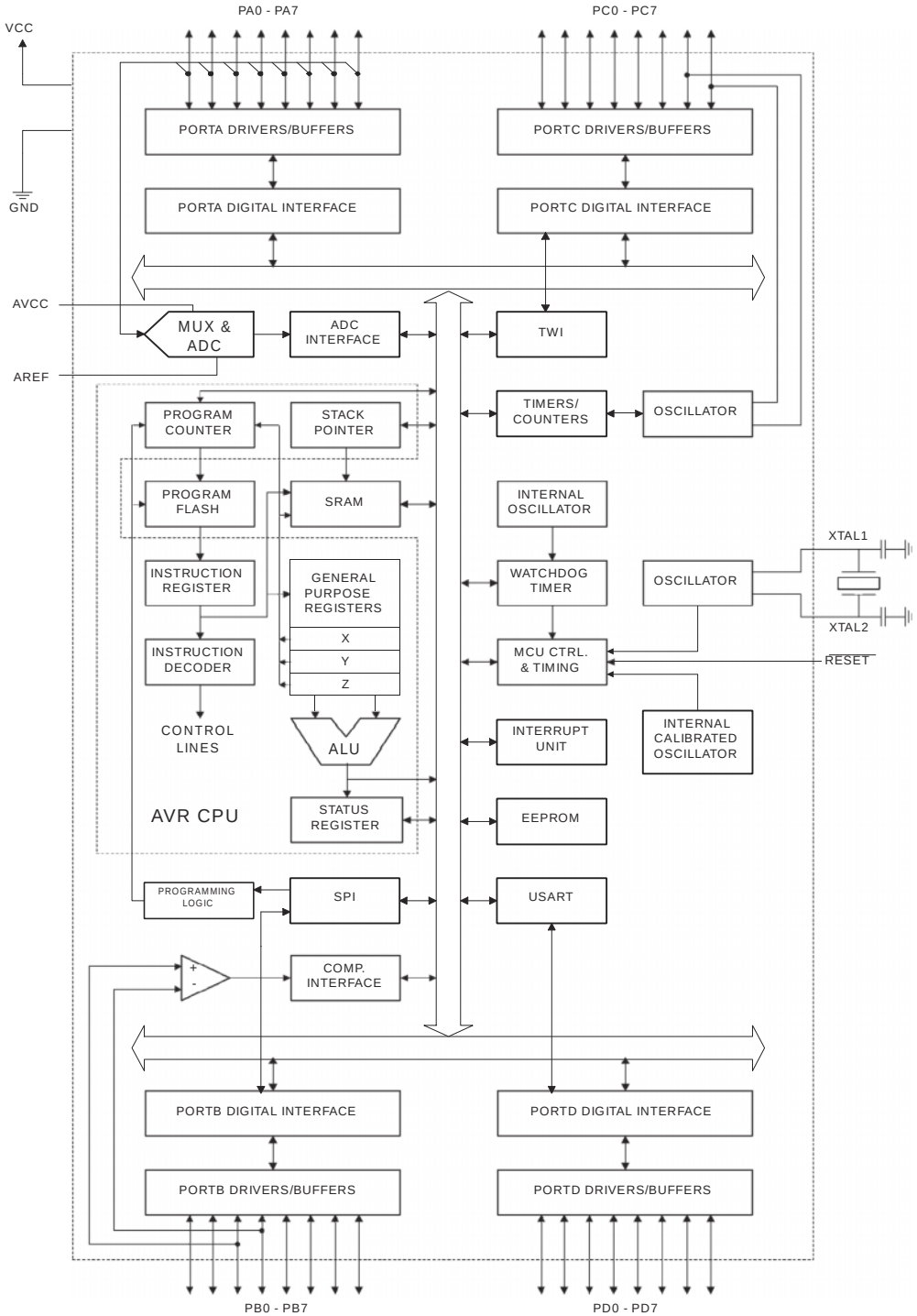
Typical values contained in this datasheet are based on simulations and characterization of other AVR microcontrollers manufactured on the same process technology. Min and Max values will be available after the device is characterized.

Overview

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

Block Diagram

Figure 2. Block Diagram



The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega16 provides the following features: 16K bytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 512 bytes EEPROM, 1K byte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary-scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

The device is manufactured using Atmel's high density nonvolatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega16 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications.

The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

Pin Descriptions

VCC Digital supply voltage.

GND Ground.

Port A (PA7..PA0) Port A serves as the analog inputs to the A/D Converter.

Port A also serves as an 8-bit bi-directional I/O port, if the A/D Converter is not used. Port pins can provide internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. When pins PA0 to PA7 are used as inputs and are externally pulled low, they will source current if the internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B (PB7..PB0)

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B also serves the functions of various special features of the ATmega16 as listed on page 58.

Port C (PC7..PC0)

Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pins PC5(TDI), PC3(TMS) and PC2(TCK) will be activated even if a reset occurs.

Port C also serves the functions of the JTAG interface and other special features of the ATmega16 as listed on page 61.

Port D (PD7..PD0)

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port D also serves the functions of various special features of the ATmega16 as listed on page 63.

$\overline{\text{RESET}}$

Reset Input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. The minimum pulse length is given in Table 15 on page 38. Shorter pulses are not guaranteed to generate a reset.

XTAL1

Input to the inverting Oscillator amplifier and input to the internal clock operating circuit.

XTAL2

Output from the inverting Oscillator amplifier.

AVCC

AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to V_{CC}, even if the ADC is not used. If the ADC is used, it should be connected to V_{CC} through a low-pass filter.

AREF

AREF is the analog reference pin for the A/D Converter.

Features

- Utilizes the AVR® RISC Architecture
- AVR – High-performance and Low-power RISC Architecture
  - 120 Powerful Instructions – Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 20 MIPS Throughput at 20 MHz
- Data and Non-volatile Program and Data Memories
  - 2K Bytes of In-System Self Programmable Flash
    Endurance 10,000 Write/Erase Cycles
  - 128 Bytes In-System Programmable EEPROM
    Endurance: 100,000 Write/Erase Cycles
  - 128 Bytes Internal SRAM
  - Programming Lock for Flash Program and EEPROM Data Security
- Peripheral Features
  - One 8-bit Timer/Counter with Separate Prescaler and Compare Mode
  - One 16-bit Timer/Counter with Separate Prescaler, Compare and Capture Modes
  - Four PWM Channels
  - On-chip Analog Comparator
  - Programmable Watchdog Timer with On-chip Oscillator
  - USI – Universal Serial Interface
  - Full Duplex USART
- Special Microcontroller Features
  - debugWIRE On-chip Debugging
  - In-System Programmable via SPI Port
  - External and Internal Interrupt Sources
  - Low-power Idle, Power-down, and Standby Modes
  - Enhanced Power-on Reset Circuit
  - Programmable Brown-out Detection Circuit
  - Internal Calibrated Oscillator
- I/O and Packages
  - 18 Programmable I/O Lines
  - 20-pin PDIP, 20-pin SOIC, 20-pad QFN/MLF
- Operating Voltages
  - 1.8 - 5.5V (ATtiny2313V)
  - 2.7 - 5.5V (ATtiny2313)
- Speed Grades
  - ATtiny2313V: 0 - 4 MHz @ 1.8 - 5.5V, 0 - 10 MHz @ 2.7 - 5.5V
  - ATtiny2313: 0 - 10 MHz @ 2.7 - 5.5V, 0 - 20 MHz @ 4.5 - 5.5V
- Typical Power Consumption
  - Active Mode
    1 MHz, 1.8V: 230 µA
    32 kHz, 1.8V: 20 µA (including oscillator)
  - Power-down Mode
    < 0.1 µA at 1.8V

8-bit AVR® Microcontroller with 2K Bytes In-System Programmable Flash

ATtiny2313/V

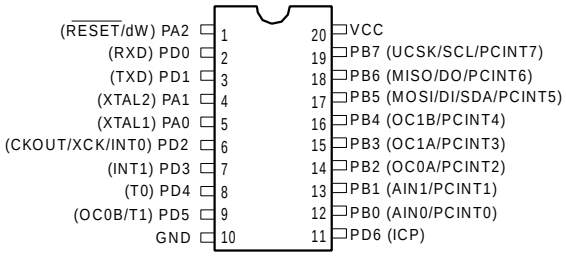
Preliminary Summary

Rev. 2543IS–AVR–04/06

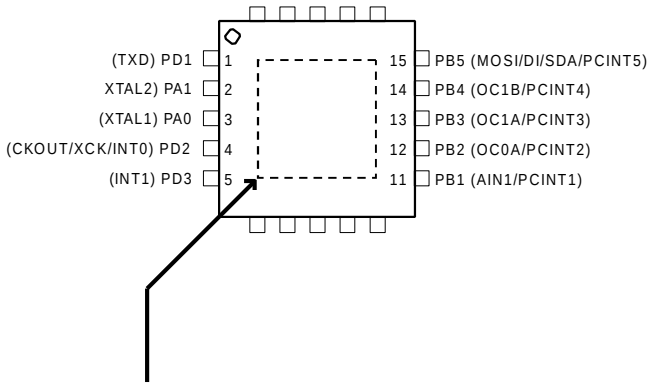
Pin Configurations

Figure 1. Pinout ATtiny2313

PDIP/SOIC



MLF



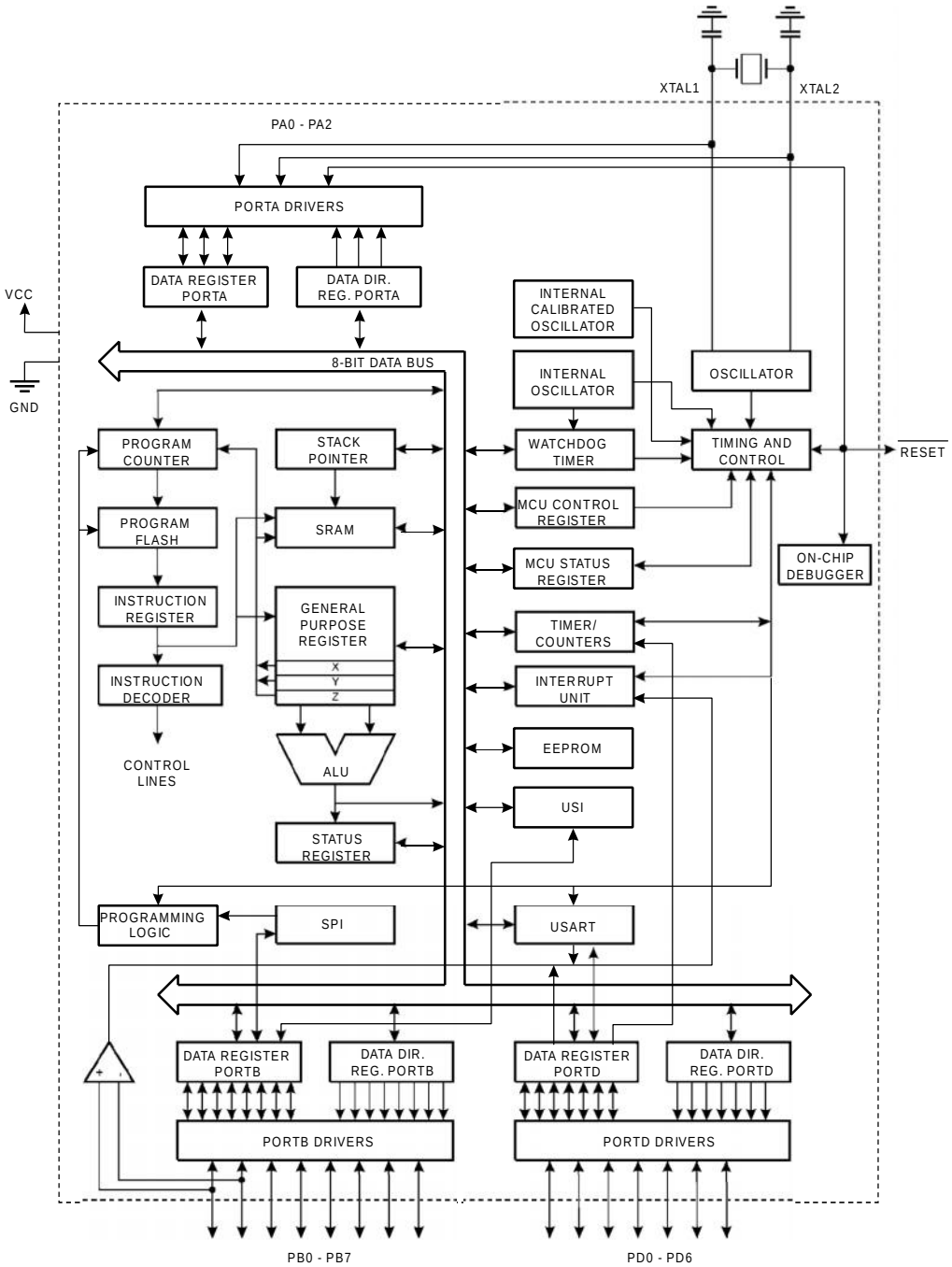
NOTE: Bottom pad should be soldered to ground.

Overview

The ATtiny2313 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATtiny2313 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

Block Diagram

Figure 2. Block Diagram



The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATtiny2313 provides the following features: 2K bytes of In-System Programmable Flash, 128 bytes EEPROM, 128 bytes SRAM, 18 general purpose I/O lines, 32 general purpose working registers, a single-wire Interface for On-chip Debugging, two flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, Universal Serial Interface with Start Condition Detector, a programmable Watchdog Timer with internal Oscillator, and three software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption.

The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed In-System through an SPI serial interface, or by a conventional non-volatile memory programmer. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATtiny2313 is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications.

The ATtiny2313 AVR is supported with a full suite of program and system development tools including: C Compilers, Macro Assemblers, Program Debugger/Simulators, In-Circuit Emulators, and Evaluation kits.

Pin Descriptions

VCC Digital supply voltage.

GND Ground.

Port A (PA2..PA0) Port A is a 3-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port A pins that are externally pulled low will source current if the pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port A also serves the functions of various special features of the ATtiny2313 as listed on page 53.

Port B (PB7..PB0) Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B also serves the functions of various special features of the ATtiny2313 as listed on page 53.

Port D (PD6..PD0) Port D is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port D also serves the functions of various special features of the ATtiny2313 as listed on page 56.

$\overline{\text{RESET}}$ Reset input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. The minimum pulse length is given in Table 15 on page 34. Shorter pulses are not guaranteed to generate a reset. The Reset Input is an alternate function for PA2 and dW.

XTAL1 Input to the inverting Oscillator amplifier and input to the internal clock operating circuit. XTAL1 is an alternate function for PA0.

XTAL2 Output from the inverting Oscillator amplifier. XTAL2 is an alternate function for PA1.

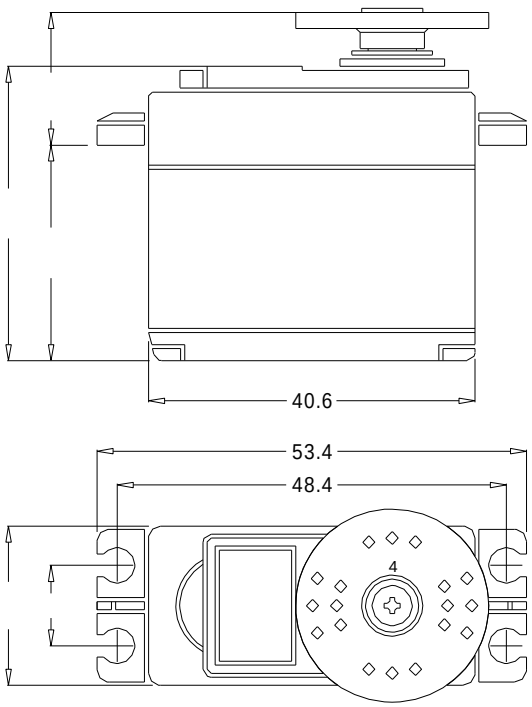
Resources

A comprehensive set of development tools, application notes and datasheets are available for downloadon http://www.atmel.com/avr.

ANNOUNCED SPECIFICATION OF HS-422 STANDARD DELUXE SERVO

1.TECHNICAL VALUES

CONTROL SYSTEM	: +PULSE WIDTH CONTROL 1500usec NEUTRAL	
OPERATING VOLTAGE RANGE	: 4.8V TO 6.0V	
OPERATING TEMPERATURE RANGE	: -20 T0 +60°C	
TEST VOLTAGE	: AT 4.8V	AT 6.0V
OPERATING SPEED	: 0.21sec/60° AT NO LOAD	0.16sec/60° AT NO LOAD
STALL TORQUE	: 3.3kg.cm(45.82oz.in)	4.1kg.cm(56.93oz.in)
OPERATING ANGLE	: 45°ONE SIDE PULSE TRAVELING 400usec	
DIRECTION	: CLOCK WISE/PULSE TRAVELING 1500 TO 1900usec	
CURRENT DRAIN	: 8mA/IDLE AND 150mA/NO LOAD RUNNING	
DEAD BAND WIDTH	: 8usec	
CONNECTOR WIRE LENGTH	: 300mm(11.81in)	
DIMENSIONS	: 40.6x19.8x36.6mm(1.59x0.77x1.44in)	
WEIGHT	: 45.5g(1.6oz)	



2.FEATURES

3-POLE FERRITE MOTOR
LONG LIFE POTENTIOMETER
DUAL OILITE BUSHING
INDIRECT POTENTIOMETER DRIVE

3.APPLICATIONS

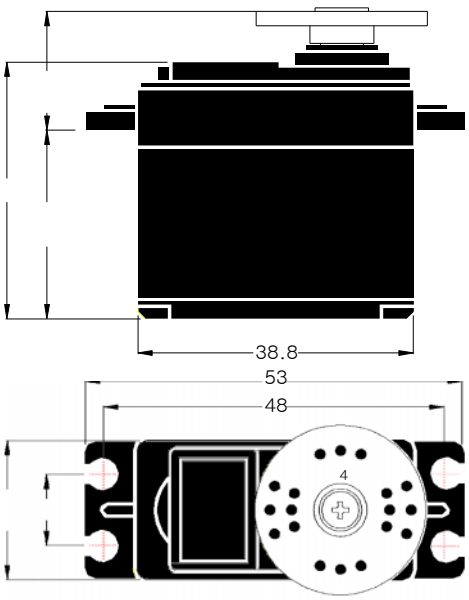
AIRCRAFT 20-60 SIZE
30 SIZE HELICOPTERS
STEERING AND THROTTLE SERVO FOR CARS
TRUCK AND BOATS

PREPARED BY JUN HEE, LEE
UPDATE:APR 01, 2002

ANNOUNCED SPECIFICATION OF HS-475HB STANDARD DELUXE SERVO

1.TECHNICAL VALUE

CONTROL SYSTEM	:+PULSE WIDTH CONTROL 1500usec NEUTRAL	
OPERATING VOLTAGE RANGE	:4.8V TO 6.0V	
TEST VOLTAGE	:AT 4.8V	AT 6.0V
OPERATING SPEED	:0.23sec/60≪AT NO LOAD	0.18sec/60≪AT NO LOAD
STALL TORQUE	:4.4kg.Cm(61.10oz.in)	5.5kg.Cm(76.37oz.in)
IDLE CURRENT	:7.4mA AT STOPPED	7.7mA AT NO LOAD
RUNNING CURRENT	:160mA/60≪AT NO LOAD	180mA/60≪AT NO LOAD
STALL CURRENT	:900mA	1100mA
DEAD BAND WIDTH	:5usec	5usec
OPERATING TRAVEL	:40≪ONE SIDE PULSE TRAVELING 400usec	
DIRECTION	:CLOCK WISE/PULSE TRAVELING 1500 TO 1900usec	
MOTOR TYPE	:CORED METAL BRUSH	
POTENTIOMETER TYPE	:6 SLIDER/INDIRECT DRIVE	
AMPLIFIER TYPE	:ANALOG CONTROLLER & TRANSISTOR DRIVER	
DIMENSIONS	:38.8x19.8x36mm(1.52x0.77x1.41in)	
WEIGHT	:40g(1.41oz)	
BALL BEARING	:TOP/MR106	
GEAR MATERIAL	:HEAVY DUTY RESIN	
HORN GEAR SPLINE	:24 SEGMENTS/ø5.76	
SPLINED HORNS	:REGULAR/R-C,R-D,R-I,R-O,R-X,SUPER/R-XA	
CONNECTOR WIRE LENGTH	:300mm(11.81in)	
CONNECTOR WIRE STRAND COUNTER	:60EA	
CONNECTOR WIRE GAUGE	:22AWG	



2.FEATURES

HEAVY DUTY RESIN GEARS, TOP BALL BEARING

3.APPLICATIONS

AIRCRAFT 20-60 SIZE, 30 SIZE HELICOPTER, STEERING AND THROTTLE SERVO, TRUCK AND BOATS

4.ACCESSORY & OPTION

CASE SET/
- HS475T:1EA
- HS475M:1EA
- HS475L:1EA
- PH/T-2 2x30 NI:4EA

GEAR SET/
- HS475G1:1EA
- HS475G2:1EA
- HS475G3:1EA
- HS475G4:1EA
- HS75PG:1EA

BALL BEARING SET/
- MR106:1EA
- CU 7.99x6:1EA
- FE 10x8:1EA

HORN SET/
- R-C:1EA
- R-D:1EA
- R-I:1EA
- R-O:1EA
- R-X:1EA
- R-XA:1EA

WH/W 2.1x15 NI:4EA
BST 3x5.5:4EA
NBR 9x6.5x6:4EA